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EDITORIAL NOTES.

Tale of the 1926 Returns.

THE Board of Trade deserve the thanks of the gas industry for their promptness in issuing the returns relating to the manufacture and sale of gas in the year of vast trouble—1926. The collective figures for the statutory gas undertakings confirm individual experiences; but it is a pity a supplementary return could not be prepared, showing, for example, the proportion of the coal used which had to be purchased abroad, and the financial liability incurred by the industry through that forced proceeding in maintaining the gas supply of the country. But the plain cold data we have before us tell the tale of notable success in achieving a great public service in the worst of experienced circumstances, and how it was accomplished, despite the greater demand for gas produced by the seven months' cessation of coal raising in the country. It was, to say the least, a great demonstration of the flexibility and adaptability of the gas industry in respect of manufacture, as well as a remarkable example of perseverance and endurance. And the knowledge of success is the only reward.

The figures show that, though the sale of gas was more during the year by 10,811·29 million c.ft., the quantity of coal carbonized was less by 467,000 tons—the total being 16,564,172 tons, as compared with 17,031,172 tons in 1925. But, on the other hand, in using 1,435,572 tons of coke, 282,159 tons more were gasified in the making of water gas; and the purveyors of gas oil were able to dispose (and not on philanthropic terms) of 36,320,745 gallons more to the statutory gas undertakings—the actual requirement in the year being 97,703,394 gallons, as against 61,382,649 gallons in 1925. This alone indicates how considerably carburetted water gas contributed to the solution of the difficult problems before the industry last year; and figures of gas production supply further enlightenment. The quantity of coal gas made was 226,572·49 million c.ft., or 4775·19 million c.ft. less than in 1925, or 2·06 p.ct. From these figures, a peculiar point is found. Though there was considerable complaint regarding the gas yield of much of the Continental coal supplied to this country, with good accounts of American varieties, it is seen that the average production over the year, for British and exotic coal combined, was 13,678 c.ft. per ton, compared with 13,583 c.ft. in 1925—an average of 95 c.ft. per ton extra. Of water gas there was a flight in production from 48,173·29 million c.ft. in 1925 to 65,309·75 million c.ft. in 1926—an increase of 17,136·46 million c.ft., or 35·6 p.ct. The total gas made of both descriptions was 296,082 million c.ft., or an increase on 1925 of 12,263·7 million c.ft., or 4·3 p.ct. Owing to the collapse of the production of coke-oven gas through the period of the stoppage, the gas industry, prior to it and subsequently, was only able to purchase from the sister industry 2475·9 million c.ft., as compared with 4797·75 million c.ft. in 1925.

The increase of business during the year was due not only to the coal strike, but to the increased number of consumers, and the additional points of use. The returns give a complete answer to the grumblers through the Press regarding increased gas accounts. Now we have it authoritatively presented that the increase in the total gas sold last year was 4·07 p.ct.; and the average increase of consumption per consumer 2 p.ct. These figures are exceedingly small contrasted with the extraordinary increases attributed to a relatively few gas accounts, not overlooking the extra price of gas due to the enormously higher cost of coal. But to actual figures. The total sale of 276,568·64 million c.ft. was greater by 10,811·29 million c.ft. than the aggregate sale of 1925, or 4·07 p.ct. The major part of this increase was due to private consumption, owing to the fact that industrial demand was, taken as a whole, adversely affected. But a curious thing is that the quarter whence the smallest noise was made respecting additional charges is responsible for the largest part of the total increase in gas sales. With an aggregate consumption of 99,301·38 million c.ft., the prepayment consumers took 6554·09 million c.ft. more; while the ordinary consumers, with a total consumption of 168,104·52 million c.ft., consumed 5045·44 million c.ft. more, or 1509 millions less than the prepayment consumers. That is an interesting revelation. Together the two increases make 11,599·54 million c.ft. But, owing to restrictions, public lamp consumption was, with a use of 9162·73 million c.ft., less by 788·24 millions, which, deducted from the combined increases of the prepayment and ordinary consumers, gave the net addition to sales of 10,811·29 million c.ft. The basis of business also continues to expand. The year closed with 4,579,691 prepayment consumers on the rental books, and 3,824,870 ordinary ones—an increase of 204,106, to which prepayment consumers contributed 133,073, and ordinary consumers 71,033. The average consumption per consumer advanced by 2 p.ct.

These are some of the interesting matters relating to manufacture and sales divulged by the gas undertakings' returns for the coal strike year. They are highly satisfactory. It will be Part II. of the returns, dealing with the finance of the year, which will merit dissatisfaction, unless we heavily discount the values of the figures by the fact of unavoidability. A fuller review of Part I. appears in later columns, and supplies additional interest.

Coal Used in the World's Gas Manufacture.

A FASCINATING study by Dr. Henry Louis, M.A., of the world's coal production and the distribution of its uses has appeared in the "Fuel Economy Review." He calculates that annually of bituminous coal 1050 million tons are raised, of anthracite 90 million tons, and of lignite 160 million tons. Adjusting lignite to its corresponding weight in bituminous coal, and including anthracite, his computation of the total coal production of the world is 1185 million tons. Of this quantity, he calculates that the coal used for domestic purposes is equal to 165 million tons; for gas production, 40 million tons; for coke manufacture, 150 million tons; for industrial heating, 50 million tons—totalling 405 million tons. This leaves 780 million tons available for direct power generation. Deducting from this his estimate of the coal used on the

railways of the world, we have available 480 million tons for generating power in stationary and ordinary industrial engines.

The figure which chiefly arrests our attention is the quantity of coal used in the world for gas production—only 40 million tons. According to Dr. Louis, Great Britain consumes for gas making 18 million tons; the United States, 5 million tons; Germany, 8 million tons—making a total of 31 million tons, and leaving for the rest of the world, 9 million tons. Of course, it is acknowledged that these figures must be taken as only approximately correct. But the point we wish to make is that a consumption of 40 million tons for the world's gas industry must not be taken as any criterion of the amount of gas distributed by it. Our first fear that Dr. Louis had gone somewhat astray in his calculations was raised by the fact that the coal consumption in Great Britain is equal to 45 p.ct. of the total coal consumption attributed to gas manufacture in the whole world; but further research shows us that his computation is perhaps as near as it is possible to get. The gas industry of the world is, of course, responsible for a much larger distribution of gas than the 40 million tons of coal suggests. In England, Wales, and Scotland the total quantity of gas made in 1925 by statutory undertakings (leaving out the non-statutory ones) was 283,818·3 million c.ft. Of this quantity, no less than 48,173·29 million c.ft. were water gas, in the making of which 1,153,413 tons of coke, and 61,382,649 gallons of oil were used. Furthermore, from the coal carbonized by the coke-ovens of the country, no less than 4797·75 million c.ft. of gas was purchased in bulk by gas undertakings for sale in their supply areas; and the quantity is largely increasing. An almost startling figure is Dr. Louis' 5 million tons for gas making in the United States, in view of the fact that the return of gas sold for 1926 shows a total of 459,326 million c.ft. In a paper read by Mr. G. M. Gill, before the Southern Association of Gas Engineers and Managers in 1925, he showed that in 1923 the sale of gas in the United States amounted to 418,000 million c.ft.; but of this quantity only 58,885 million c.ft. was coal gas manufactured by the works themselves, while their production of carburetted water gas reached no less than 230,206 million c.ft. In addition, coke-oven gas was purchased and distributed to the extent of 65,872 million c.ft. Natural gas was bought and mixed with manufactured gas to the amount of 38,410 million c.ft.; and oil gas was made to the extent of 24,627 million c.ft.

All this shows that the use by the gas industry of water gas, coke-oven gas, gas from complete carbonization plants, and natural gas (in America), has completely upset the tonnage of coal carbonized as affording any safe basis for calculating the dimensions of the gas industry of the world. Of course, this is not the object Dr. Louis had in view; but there is just the danger that, as his figures stand, some investigators, who are interested in the question of the distribution of the world's coal supply for different purposes, may be misled as to the dimensions of the business of the gas industry by utilizing the data as presented. It might be thought by those ignorant of the actual circumstances that, in all other countries of the world, the utilization of gas must be a receding quantity in view of the predominant place occupied by the gas industry of Great Britain in the utilization of coal for gas-making purposes. The American figures, as we have given them, of course, contradict any assumption of the kind. During the past three or four decades, there has been a gradual and indeed remarkable change in the utilization of materials and plants for gas-production purposes. Plants are used more efficiently, and a greater quantity of gas is made per ton of coal. Despite the enormous expansion of the gas business, through recourse to other materials than coal and to gas from coke-oven plants, the gas industry has done more than perhaps any other industry in conserving our stores of coal. But now time is causing some retracing of steps in America. Owing to the petering-out of some of the natural gas wells, and to the high price of oil for enriching water gas, there has been the last few years a very noticeable increase there in the adoption of modern coal-gas manufacturing plants—in fact, the United States are prominently sharing in developing improved working in this direction.

Electrical Gas and Explosion Producers.

From the first, coal gas disowned all participation in the explosion at Acton last February, which killed a woman and wrecked a shop; and there was full endorsement at the inquiry held by Mr. G. Scott Ram and Dr. J. S. Haldane, as reported in the "Journal" for June 22 and 29. The tribunal was appointed by the Electricity Commissioners; and their report, according to "The Times," completely exonerates coal gas from participation. It was perfectly obvious from the evidence that this was the only conclusion at which the two authorities could arrive, and that a fusion and a bitumen integument to a cable provide all that is required for the production of a highly explosive and poisonous gas. The evidence of Prof. R. V. Wheeler also disclosed that, in the Acton circumstances, the produced gas would be of sufficient volume to accomplish all the damage that was experienced. Bitumen covering for cables is disappearing as new work and renewals allow; experience shows it is far too dangerous in view of the disorderly disposition of cables to fuse when and where least expected. The Inspectors, it is noted, emphasize that electric services should be taken into houses in such a manner that gas cannot enter; and they denounce the practice of not giving the station attendant discretion to switch-off before obtaining instructions in the case of a heavy fault in bitumen coated mains. This is another experience to add to others—gas undertakings should never, without the minutest inquiry, admit that an explosion is due to coal gas. Electricity undertakings are quite willing to shift the responsibility for their own misdoings; but town gas suppliers should ensure that they shoulder no more responsibility than is a genuine liability.

Reinforced Concrete in Road Construction.

Some years ago, the late Sir Corbet Woodall, referring to the use of reinforced concrete in road construction, stated that it made his heart bleed to see this good material drilled and broken up, at an enormous cost, in order to lay a line of pipes or cables or to effect renewals or make connections. What he would have said had he been here to inspect the condition of Piccadilly to-day, we cannot state; but it would probably have been something much stronger than his utterance at the time to which we refer. Piccadilly is closed to road traffic for about four months, owing to the need for the reconstruction of the roadway; and while this is being done—in order to save further trouble for, it is hoped, many years—the concrete bed is being broken up and removed, and the whole of the property of the public utility services is being overhauled or renewed. The uncovering of this property has revealed a network of pipes and cables, which is one of the amazing features to laymen who had previously little conception of the amount of subterranean transmission work required in a single thoroughfare for their service. Being out of sight, it does not come within the ambit of general knowledge. It is, of course, very right and proper that such work should be undertaken while the roadway is being renewed, though at the same time, apart from public inconvenience, it imposes a vast amount of work and considerable expense on the undertakings concerned—in some cases, before overhauling and renewal are actually required.

Piccadilly, however, has again raised the question as to whether something could not be devised which would obviate the necessity for concrete road beds being broken up when any one of the public services desires to repair or renew its pipes or make connections. No better means of construction for roadways carrying such a large volume of modern fast-moving traffic has yet been discovered; and therefore those concerns who have property in the subsoil have to accept this modern condition with the best grace possible, knowing at the same time that it has a protecting advantage, so long as things remain normal, but, in the event of a fault developing, it makes location an unpleasantly difficult thing. Though this has been a problem for years, our civil engineers and the distributing engineers of our great public utility services have not been able to plan anything better—something

which would reconcile the concrete bed to the accommodation of public service systems. Of course, there is the provision of tunnels to accommodate mains and cables. But here again the construction of tunnels large enough for the purpose—adequate in dimensions for the habitation of many pipes and cables, and for inspection and maintenance work to be conducted in them—costs much both in construction and upkeep. Not long ago, the Ministry of Transport and the London Traffic Advisory Committee told a deputation that a tunnel sufficient in size for the mains and cables in the subsoil of Piccadilly would cost upwards of a million sterling per mile. This is a serious figure to place against the infrequency with which (say) gas mains require renewal or repair under a roadway with a concrete bed. However, this experience in Piccadilly may lead to a deliberate exploration of the subject, to see whether anything more practicable can be done.

Coincidently with this Piccadilly trouble, we have the Cornhill catastrophe. The collapse last Sunday week of an end wall of the Commercial Union Buildings and other damage to property have revealed a tremendous cavity under the roadway concrete bed; and passing through this were sagging mains and cables. With no support to the concrete bed, one can imagine how near were other possible disasters. There is no clear information as to how this all happened; but it is not a comfortable thing to contemplate subsoil shifting in this fashion, and large cavities being formed under an unsupported concrete roof, with gas and water mains and electric cables suspended in them, and traffic passing overhead in the usual manner. There we have illustrated a disadvantage of the road concrete bed which might aid and abet a great catastrophe.

Changes in Industrial Distribution and Factory Conditions.

A change in the geographical distribution of industrial activities is going on in this country—perhaps almost imperceptibly, but nevertheless real. This is a good thing for the country at large; it is also a beneficial movement for those public utility undertakings which at one time had little in the way of local industry with which to do business. Information regarding this development of the distribution of industrial work is found in the annual report of the Chief Inspector of Factories and Workshops (Mr. Gerald Bellhouse), which was noticed in the "Journal" last week. There has been considerable industrial migration to the outer suburbs of London and the Home Counties, and, in fact, throughout the Southern area. Industrial devolution is likewise going on in the Provinces. Factory owners are getting more discriminating, and have new ideas. In some cases, they find the local rates are lower in the suburban and provincial areas than in the cities and large towns. They have also discovered that space is beneficial to their operations; that the conditions in the outlying districts are more favourable to the health of their employees than the crowded areas of London and other large cities; that healthy conditions have a good effect upon the efficiency of the workers; and that, in the traffic circumstances of to-day, it must frequently contribute to economy and efficiency for the works to be taken to the employees than for the employees to have to travel to and fro every day.

The statistics published by the Ministry of Labour, as well as data obtained by the District Inspectors of Factories and Workshops, supply confirmation. If we take the number of persons insured under the Unemployment Insurance Acts, it is seen that, in the case of some industries, an increase in the South has been concurrent with a decrease in the North; but in most industries there has been a gradual increase in total numbers during the last three years. The increase has, however, been greatest in the Southern area, including Greater London, and amounts to 11·58 p.ct. in the South-Eastern area, as compared with 5·17 p.ct. in the Midlands, 2·56 p.ct. in the North-Eastern district, and 3·41 p.ct. in the North-Western district. This increase is reflected also in the number of accidents reported to the Factory and Workshops Inspectors. While in 1926 there was a marked decrease of accidents due to trade depression in the great majority of districts, the London, Reading, Ipswich, and Norwich areas all show slight increases. The large changes which have taken place in our modes of living, our customs, in our means of transport, and so forth, have no doubt been largely instrumental in promoting change, combined with the modern views as to the working and housing conditions of the masses. The higher education of the people, too, has led to changed views on their part regarding standards of life. Another feature is that the new industries that have grown up of late years are not of a character which does much to depreciate or mar the districts in which they settle. Many of them are industries which do not produce, for instance, large quantities of smoke or refuse; and even new works and factories which are representative of the old-established industries of the country, but which have been planted in fresh parts of the country, have been designed and set-up with all the experience that has accrued, and thus incorporate the most modern approved methods—including gas heating and power and the electric drive. There are in the country many gas undertakings whose business has been purely of a domestic and shopping character; and to many of these the birth of manufactories in their midst has the twofold advantage of giving them, though in some cases it may be small, an industrial day load, and also a field for the extension of business among the new workers.

There is not much in the other parts of the report which directly affects the gas industry, although there is a great deal which is of interest to those who are concerned in the health, efficiency, and general welfare of the workers in factories and workshops; and they would do well to obtain possession of a copy, for in many respects it is worth study. But touching upon two or three matters of more or less direct interest to our industry, we are glad to see that systematic attention is being given by the regional staff of the Chief Inspector's Department to the question of adequate lighting—both natural and artificial—in factories and workshops. It is found by the District Inspectors that manufacturers generally are now realizing more and more that, if output and good workmanship are to be maintained, lighting must be adequate in amount and suitable for the particular work in hand. There is greater appreciation regarding the need for both individual or local lighting and general lighting, and the best way to give effect to the requirements. The evil effects of glare are being more and more demonstrated: and there is a larger adoption of special reflectors and shades to prevent glare affecting the eyes of workers and to obviate shadows. This greater study of suitable lighting is a considerable aid to works economy and efficiency. It is strange that this appreciation has been so long coming, and has necessitated so much work and propaganda to bring it about. But it is only another illustration of the difficulty of dethroning traditional or conventional methods. Accompanying lighting is ventilation; and this again, we see from the reports, is receiving much more attention than was customary in times past.

Interest is also found in other sections of the report, in which we find that improvement is constantly going on in the conditions of employment, and in the promotion of welfare work and other beneficial influences, to the great advantage of the workers. Among the interest observed in this regard is the effect of repetition work on young people; it is the outcome of mechanical operation which, so far as work is concerned, produces monotony. This is not beneficial in the case of youth; and counteractives are required, and are being introduced in the intervals for leisure allowed during the day. Mention is also made of labour-saving appliances; but it ought not to be imagined that the introduction of these in all cases necessarily leads to monotony. They have helped to develop manufacturing industries; and their character and use have brought about a requirement for skill in operation and attention of a totally different order from that needed in the past. Such appliances, too, as is recognized in the report, have provided large relief from the manual strain which formerly existed. There is reference also to the great value of the regulations which apply to dangerous trades; and it is claimed that their operation has been to diminish the incidence of industrial

diseases. No one can deny this; but we think it may rightly be submitted, and should be claimed, that the improved conditions of the workers in factories have also done much to combat the deterioration of health which previously occurred.

Gas Salesman's Day.

An educational treat is in store for the Gas Salesmen's Circles on the occasion of their annual meeting in London on Friday, Sept. 16. Every salesman who can be spared from duty that day—and the number who can be relieved should be the maximum—will have a programme before him which it would be hard to equal, because (in addition to the ordinary business and, it is hoped, an address by that eminent expert on salesmanship, Mr. H. Ernest Hunt) the Governor (Sir David Milne-Watson) and the Board of the Gas Light and Coke Company are kindly permitting facilities for the Circles to visit the Watson House Training Centre, the stove and meters shops of the Company at Haggerston and Fulham, and the Company's new showrooms, large and small. The Company's belief in public service, demonstration, competent men, and maintenance is materially manifested by the liberal expenditure they have made in these directions during the past few years. It is all part and parcel of a great business development policy on the most modern lines; and the salesmen who are fortunate enough to get to London for Sept. 16 will have a profitable and memorable experience. Every responsible Manager should see to it that as many members as possible of his sales and public service staff are enabled to participate. It will benefit not only the individual, but the undertaking.

Imported Coal.

Imports of coal have not altogether discontinued. A contribution to the contracted-for quantity was made in July. It only amounted to 42,616 tons. July last year saw an inflow of 4,105,379 tons in excess of that amount; and happy we then were to welcome it.

The Revolt.

The correct trade union spirit was revealed at a mass demonstration of members of the Northumberland Miners' Non-Political Trade Union at Newcastle-upon-Tyne on the 7th inst. Among the speeches made on the occasion was one by Mr. J. H. Seddon, an ex-Chairman of the Trade Union Congress. He spoke of the meeting being a living demonstration of the revolt that was spreading throughout the country against extremist trade union methods. The Miners' Non-Political Union are not opposed to trade unionism; but they are the inheritors of the glorious spirit that made the trade union movement. Mr. George Spencer, M.P., spoke against the foolish "philosophy" of communism, which advocates the destruction of the economic fabric as the means of winning a higher standard of living for the workers.

Manufactured and Natural Gas Wedded.

An official joint statement announces the consolidation of the Natural Gas Association of America with the American Gas Association. It is signed by Mr. Alexander Macbeth, President of the American Gas Association, and Mr. N. C. McGowen, President of the Natural Gas Association of America, and reads as follows: "We take pleasure in announcing that, all essential details being complete, the Natural Gas Association of America and the American Gas Association are amalgamated into a single body under the name of the American Gas Association, Inc., as from Aug. 1, 1927. All elements of the gas industry in North America, manufactured and natural, are now one body united for the advancement of the industry, and the development of its usefulness to the people whom it serves."

Scottish Junior Gas Association.—The Joint Transactions of the Eastern and Western Districts of the Scottish Junior Gas Association for 1926-27, which has just been published, is a record of a highly successful session. In addition to an account of the work accomplished, the volume contains lists of the Officers and members.

PERSONAL.

Mr. Lawrence H. Sensicle, B.Sc., F.I.C., Chief Chemist to the Stella Gill Coke and Bye-Products Company, has been appointed to the position of Chief Chemist to the Newcastle and Gateshead Gas Company, held by the late Dr. Geoffrey Weyman. Mr. Sensicle took over his new duties on Aug. 1.

The Directors of the Pitlochry Gas Company have instructed Mr. L. Hislop, Consulting Engineer, to prepare a valuation of the works and plant of their undertaking. Mr. Hislop is now resident at "The Hydro," Peebles.

Among the names appearing in the list of successful candidates for the B.Sc. (London) external examination held in July was Mr. Leslie B. Chapman, who is an Assistant on the Chief Engineer's staff of the Newcastle-on-Tyne and Gateshead Gas Company.

Mr. Robert Gray, Assistant Gas Engineer and Manager to the Greenock Corporation, has been appointed Assistant to Mr. W. H. Packham, the Managing Director of the Kingston-on-Thames Gas Company.

Mr. George Moore Gledhill, Manager of the Driffield Gas-Works, was married on Aug. 10 to Miss Emily Hornby, of Driffield.

OBITUARY.

DR. A. C. HUMPHREYS.

It is with the greatest regret that we have to record the death of Dr. A. C. Humphreys, the eminent gas engineer, which took place on Sunday last. Not long ago—in the "Journal" for Dec. 15 last—announcing the retirement of Dr. Humphreys from the Presidency of the Stevens Institute of Technology of Hoboken, N.J., we devoted an Editorial article to the life of this distinguished engineer, whose influence, as was then remarked, has left a deep and indelible impression upon engineering technology in the United States.

Dr. Humphreys was born in Edinburgh in 1851, and went to the United States when he was eight years of age. His sterling work in gas engineering soon won world-wide recognition; and when, twenty-five years ago, he became President of the Stevens Institute, he could have been designated the pre-eminent gas engineer in America. In succeeding years he attained similar prestige among technological educators. As recorded in the "Journal" last December, while he was a partner in the firm of Messrs. Humphreys & Glasgow he lost his two sons by drowning in the Nile; and it was this tragedy which led to his wonderful administrative abilities being diverted from gas engineering to educational work.

Many men have a desire to help their fellow-beings to live a fuller, a more human life; but the great capacity which characterized Dr. Humphreys' endeavours to fulfil this desire is given to few. His example and teachings have enriched the lives of many who had the good fortune to be associated with him; and, through them, his good work will be carried on.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organisations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Sept. 1.—Midland Junior Gas Association.—Meeting at the Council House, Birmingham, at 6.15.
Sept. 2-12.—Coke Oven Managers' Association.—Continental tour.
Sept. 7-9.—North British Association of Gas Managers.—Annual general meeting in Dumfries.
Sept. 13.—National Gas Council.—Meeting of Central Executive Board.
Sept. 13.—Federation of Gas Employers.—Meeting.
Sept. 16.—Gas Salesmen's Circles.—Annual meeting in London.
Sept. 22.—Wales and Monmouthshire District Institution.—Meeting at Porthcawl.
Sept. 23.—Southern Association of Gas Engineers and Managers.—Visit to the Torquay Works of the Torquay and Paignton Gas Company.
Sept. 30.—Eastern Counties Gas Managers' Association.—Annual meeting at Cambridge.
Oct. 3-5.—British Commercial Gas Association.—Sixteenth annual general meeting and conference at Southampton.
Oct. 27.—Midland Association of Gas Engineers and Managers.—Autumn general meeting, Grand Hotel, Birmingham, at 2.30.

Institution of Gas Engineers.

Sept. 12.—Finance Committee.
Sept. 12.—Council meeting.
Sept. 12.—Visit to the Shipping Engineering and Machinery Exhibition at Olympia.
Sept. 13.—Education Committee.

ELECTRICITY SUPPLY MEMORANDA.

Electrical Accidents.

To the Annual Report of the Chief Inspector of Factories and Workshops for 1926, the Senior Electrical Inspector (Mr. G. Scott Ram, O.B.E., M.Inst.E.E.) makes his usual contribution. As a preface to his comments on the electrical accidents which occurred in factories and workshops during the year, he refers to the effect of the prolonged coal strike upon the interests of the electricity supply industry, and also to the increased activity in the industry, owing to the passing of the Electricity Supply Act, in respect of constructional work for generation, and to the boom in electrical exports. Turning to the industrial electrical accidents during the year, he states that the number of reportable ones was 338, including 17 fatal cases, as against 414 and 24 fatal cases in the previous year. This is a reduction of about 18 p.ct., and is mainly attributable to the coal stoppage, as the reduction occurred almost entirely in the districts comprising the heavy iron and steel works and shipyards, where there was considerable closing down during the year. Of the accidents 32 occurred on high-tension systems, 22 of them (four fatal) being in generating stations or sub-stations of authorized public supply undertakings. Most of these accidents—16, including three fatal—occurred to persons cleaning or otherwise working on, or adjacent to, live switch gear or other apparatus. This class of accident, even when not fatal, is apt to be extremely serious; the victims in several cases losing a limb, or being otherwise crippled for life. The comments which follow on certain of the cases indicate that to the invisibility of the danger, or rather to the absence of any indication of it to the senses until the trouble happens, are attributable many of the mishaps. Even highly skilled persons are liable to make disastrous mistakes in moments of inadvertence or otherwise; and, therefore, it is hardly to be wondered at that persons competent only to work under the immediate supervision of authorized persons should meet with similar accidents. Cleaning operations are, of course, necessary; and there can be agreement with Mr. Scott Ram that, considering the large amount of this work which is constantly going on, the accidents are very few indeed. In other directions, it is seen that fatal accidents have been due to carelessness in the non-observance of the routine rules of the works, and to lack of the most elementary precautions. In another part of the main report, it is stated that the number of coal gas accidents was 26 (one fatal), and of these eleven occurred on gas-works.

Accidents at Factory Plants.

Commenting on these, Mr. Scott Ram reports that three fatalities were due to the omission of, or inefficient, earthing of motors or starting gear. In one case, in a saw-mill, a motor and saw were mounted on the same iron bedplate; the earthing was by the holding-down bolts in the concrete foundation. The supply was from a sub-station on the premises—440 volts, three-phase; the neutral point not being earthed. It was realized that something was wrong with the plant, as, when switched on, sparks were observed at a part of the conduit. One of the men took hold of the hand wheel of the saw, and was killed. Subsequent tests showed that the saw and motor, &c., were live at 440 volts; there being also an earth fault on another phase of the supply. At the inquest, the electrician stated that he was self-taught, and knew of no other method of earthing than by foundation bolts. In another case, the electrician was a highly skilled man. There had been trouble with the starting-up of the motor (440 volts, three-phase), and a new starter was connected up as an experiment. As it was only on trial, the electrician had not thought it necessary to connect it to earth. Unfortunately it developed a fault, and the motor stopped. An apprentice electrician, who went to investigate, was killed by shock from the starter. The apprentice was the son of the responsible electrician. Another case was that of a girl engaged in cleaning two spinning-frames, each driven by a 5-H.P. motor. One frame was running, and the other standing. She was engaged in cleaning the latter, and was kneeling on the floor. She had no shoes or stockings on, and her feet were in contact with the running machine, when she received a fatal shock. It transpired that a fault had occurred on the motor of the running frame, which had become charged. Since the accident, a separate copper earthing system has been installed throughout the works.

Portable Electric Apparatus.

In the next section of the report, Mr. Scott Ram deals with the use of unearthed portable apparatus, which, as usual, caused several accidents, including some fatal ones. These are attributable to ignorance and to the truth of the old adage that "Familiarity breeds contempt." It is, in fact, mentioned in the report that the neglect of precautions without accident causes people to fail to realize that they may do so once too often. In some cases, it is due to the indifference of the makers of the apparatus to providing ready facilities for earthing. Thus portable electric drills and other tools are made up and sold with a few feet of twin flexible wire terminating in an adapter for connecting to an ordinary lamp holder, instead of with a three-wire flexible; the third wire being for earthing, terminating in a three-pin earthing plug. Among the fatal accidents was one in the basement of a boiler-house of a municipal generating station. Work was being done in a steel flue for forced draught, and the use of an electric drill was required. Three-pin plug connectors, with earth connections, were provided on the wall near-by for the very purpose of connecting such apparatus. In this case, however, the drill was provided only with a twin flexible and adapter. Connection was therefore made to the circuit without using the earthing arrangements provided, or any other in lieu thereof. Although a fault in the drill was at once indicated by the fuse blowing with the drill resting on the metal floor of the flue, it did not serve to convey any warning of danger to the men, or to the electrician who was called to examine it. It was then placed on a wooden box and the fuse restored, and was found to work all right. Two men standing on the earthed metal flue then proceeded to lift the drill. Both received severe shocks—one being killed. Two further fatalities are noticed, in which electric drills were concerned. In each case a man was actually using the drill when he collapsed and died. The drills were connected by adapters in a lamp-holder, and were not earthed. Also reported are several serious shock accidents to persons using ordinary metal lamp holders on flexible wires as portable lamps, in one case with fatal result.

Danger of Alternating Current.

In previous reports, Mr. Scott Ram has drawn attention to the danger of shock from alternating current at low pressure—*i.e.*, not exceeding 250 volts, such as is delivered to consumers' premises from public supply mains. This danger, he asserts, is still not generally realized even by electrical engineers. Most of the fatalities have been from circuits of 200 to 250 volts, which is the range of ordinary supply systems; although the actual pressure received by the victim may have been considerably less in some cases, it has not been definitely ascertainable. During the year under review, there were five fatal cases, as against twelve the year before. One of these was of particular interest in showing that a very low pressure may be dangerous if the conditions are specially favourable to good contact. It is often asked what pressure may be regarded as absolutely safe; and Mr. Scott Ram truly answers that this depends entirely upon the conditions of contact. In the case in question, the pressure of the circuit could not have exceeded 64 volts, and was probably only about 55 volts. It is obvious, although mention is not made of the fact, that the instance to which reference is made is that of the unfortunate youth who grasped a charged wire which had been put round a coal heap in South Wales for the purpose of stopping depredations during the coal stoppage. In this case, the Senior Inspector states that the duration of the shock was from one to two minutes, and, had the ground been dry, doubtless no such accident would have occurred. As he has mentioned in former reports, one of the chief contributory causes to low-pressure alternating fatalities is the fact that, at pressures above about 40 volts with alternating current, a person grasping a live conductor, and getting a shock through his body, may be unable to release himself—a condition which clearly existed in this instance. In previous reports, there have been references to the fact that there is a very narrow line between a trivial and a serious electric shock. In the course of a year many people receive electric shocks of varying degree without any serious consequences. Some cases, however, come very near to being fatal, but, by reason of the fact that a victim is not kept away from work for a period of over three days, are not reportable. A few are, however, reported or otherwise come to the knowledge of the Department; and among those investigated last year was a case where an electrical fitter received a 6660-volt shock and was rendered insensible. He was brought round by artificial respiration, and returned to work in two days. In another case, a man was rendered unconscious by a shock at 220 volts; and he returned to work within three days. It is, therefore, obvious that conditions have as much to do with the seriousness of an accident as the degree of voltage.

Fatal Accidents and Voltages.

In a table at the end of the report, Mr. Scott Ram gives detailed information regarding the voltages and system in respect of the 17 fatalities to which he refers. The voltages of the systems ranged from 33,000 down to 110; the probable voltage of shock from 19,000 down to 64. In ten of the cases the probable voltages were 650, 500, 440, 415, 400, 250 (2), 240, 230, and 64. Therefore, five of the cases came within the voltage range of ordinary town supply During the year, eleven prosecutions were taken for breaches of the Acts and regulations; convictions being obtained in some cases, and penalties varying from £2 to £100 imposed. A case was also taken, with the consent of the Electricity Commissioners,

in respect of a breach of their regulations by a public supply authority on factory premises; the full penalty of £10 being imposed.

The Northumberland and Newport Clauses.

It is a mysterious thing that electricity supply undertakings have such a strong aversion to the insertion in their Orders of clauses such as the Northumberland. The point again comes to notice by a report in an electrical contemporary for July 28 of an inquiry held at Weymouth by Colonel Elkin, on behalf of the Electricity Commissioners. The Corporation were applying for an Order to enable them to make extensions in a wide area of South Dorset, the rural character of which causes the scheme to be on the speculative side. Anyway, such a large ratepayer and competitor as the Gas Company—unable themselves to fall back upon the rates, and not wishing to have to subscribe to any deficiencies brought about by the speculative adventures of the competing Electricity Department—were perfectly within their rights in asking for the incorporation in the Order of the Northumberland clause; and, while they were about it, they also sought the inclusion of the Newport clause. Both of them have, after full inquiry, received the sanction of Parliament. The Northumberland clause is, of course, to ensure that operations are carried on so that an undertaking is self-supporting, while the Newport clause is directed to preventing His Majesty's subjects being deprived of their liberty in respect of the agent they shall employ for light, heat, and power, by an autocratic local authority taking advantage of their position, as housing authorities, to compel patronage of electricity. In considering the insertion of such clauses, the question is not what has been the previous behaviour of a Corporation, but what they or their successors might do in different circumstances. No allegation was made by the Weymouth Gas Company that the Corporation had at any time acted *ultra vires* or improperly; they simply sought protection for the future, which is a politic act. Now why is it, if a local authority intend to work on genuine commercial lines, they object to such a clause as the Northumberland one? It can surely do them no harm if they conduct their trading in a truly businesslike manner. If they do not desire to do so, then we can understand their objection. Moreover, whatever good resolutions may govern them, they cannot bind all future Councils to pursue the same path; and, jealous of business integrity, they ought to be willing parties to ensuring that their present high trading principles shall always be applied to the undertaking.

COKE OVEN MANAGERS' ASSOCIATION.

Continental Tour.

The following is the programme arranged for the Continental tour of the Coke Oven Managers' Association:

Sept. 2.—Leave London.
Sept. 3.—Arrive Essen.
Sept. 4.—Visit German Otto installation at Dahlhausen, also new battery under construction (72 ovens) at Bruchstrasse.
Sept. 5.—Visit the Bruckhausen Works of Messrs. Thyssen, by the invitation of the Koppers Company; also the Koppers Silica Brick Works at Düsseldorff.
Sept. 6.—Leave Essen for Brussels.
Sept. 7.—Visit the State Mines at Heerlem by the invitation of the Coppée Company. In the afternoon a visit will be paid to the Maurice Mine.
Sept. 8.—Visit the Piette installation at Alliance Monceau, near Charleroi, at the invitation of the Semet-Solvay & Piette Company, Ltd. In the afternoon visit the new Becker installation at Chatelineau, near Charleroi, at the invitation of the Woodall-Duckham Company.
Sept. 9.—Visit the Carl Still benzole plant at Jette-St-Pierre, Brussels, in the morning. In the afternoon leave Brussels for Lille.
Sept. 10.—Visit the Synthetic Ammonia Works at Waziers, near Douai, by invitation of Messrs. Simon Carves, Ltd. In the afternoon proceed by chars-a-bancs to Ostend.
Sept. 11.—Visit the synthetic ammonia installation and new Semet-Solvay battery at Ostend.
Sept. 12.—Return to London.

Reactivity of Coke.

In the July issue of "Industrial and Engineering Chemistry," Prof. S. W. Parr and W. D. Staley published measurements on the reactivity of carbon. Two preparations were used—carbon from the action of sulphuric acid on sugar, and coke from an Illinois coal. It was found that the higher the temperature to which the sample was heated before testing, the less was the reactivity. This accords well with previous work. For coke prepared at 500° C., the temperature at which it overtook the furnace temperature was 144° C.; while, with 600°, 700°, 800° and 900° cokes, the respective temperatures were 178°, 218°, 314° and 456° C. Sugar carbon behaved similarly, but the actual temperatures were lower than the corresponding temperatures when coke was used.

BELGIAN GAS ASSOCIATION.

On p. 88 of the "JOURNAL" for July 13 we reported the Jubilee Meeting of the Belgian Gas Association. We are now able to reproduce a photograph of their esteemed President, M. Joseph de Brouwer, of whom Mr. John Wilkinson, who attended the meeting on behalf of the Institution of Gas Engineers, said: "I could pay him no higher compliment than to

THE PRESIDENT,
Joseph de Brouwer.

express the opinion that he is a worthy son of a worthy father. You have referred to the assistance which the members of your Association have received as the result of research and propaganda work carried out in England; but I would remind you that your Association has produced many brilliant gas engineers, and there are a good number of British gas engineers, including myself, who are still using coal and coke handling machinery which was the result of the inventive skill of one of your former members. The name by which that machinery is known is 'De Brouwer,' and it is a significant fact that a son of the inventor occupies the Presidential Chair of your Association on this important occasion."

Carbonization of Particles of Coal.

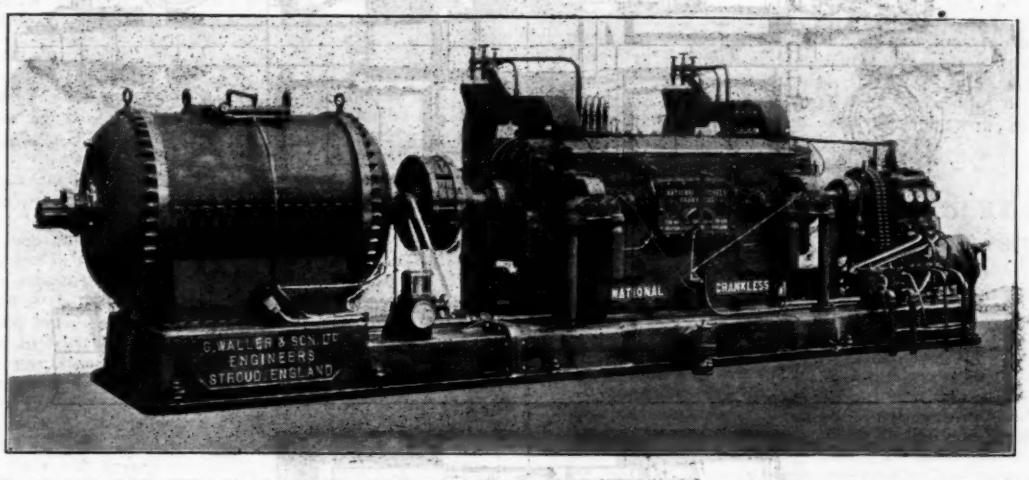
In the issue of the Journal of the Society of Chemical Industry for Aug. 12 is published a paper by F. S. Sinnatt, A. McCulloch, and H. E. Newall on "The Carbonization of Particles of Coal. The Study of Cenospheres, Part 5." In this paper the influence of various atmospheres upon the structure of "cenospheres" is described. Reduction of pressure, and, to a smaller extent, an atmosphere of steam inhibit the formation of the typical cenosphere window and lattice structure, appearing to allow of the escape of the gas produced during the decomposition of the coal. This does not seem to occur in the case of the cenospheres produced in nitrogen, coal gas, or hydrogen. The gas produced distends the particles to form cenospheres. In mixtures made with increasing quantities of electrode carbon the cenospheres produced from coal and electrode carbon become reduced in size, and the structure is also modified. Pulverization and briquetting appear to cause the formation of small cenospheres within a larger particle, so that the larger particle presents the appearance of a blackberry, the surface being covered by protuberances, each of which appears to be an individual cenosphere, either fully formed or in formation.

Heat Engine Trials.—In the "JOURNAL" for July 6, p. 40, there was an account of a meeting of the Joint Committee appointed through the action of the Institution of Civil Engineers to revise and extend the report on steam engines and boiler trials published in 1913 by a previous Committee. At this meeting the Joint Committee submitted their report. The latter has now been published by Messrs. William Clowes & Sons, Ltd., at 5s. net.

MICHELL CRANKLESS GAS ENGINES AND BOOSTERS.

An Engineering Achievement.

Sir Dugald Clerk's opinion on the National-Michell Crankless Engine is given in this article. He firmly believes it to be an excellent engineering proposition, and thinks that it will open up a new field for gas engines of far larger powers than have hitherto been attempted Its use will enable gas-works to generate electricity by high-power gas engines occupying very small space, as well as to boost gas efficiently and at even pressure. Mr. B. B. Waller's views on the crankless booster and compressor are also given. Careful tests have been made by his firm; and he has great hopes for the future of the crankless type of booster—particularly where large units are required. The outstanding features of the machine are high volumetric efficiency, small space occupied, and perfect balance at high speeds. Several sets can be run in parallel without reduction of efficiency.



ONE OF THE HALF-MILLION C.FT. PER HOUR CRANKLESS SETS FOR THE AUSTRALIAN GAS LIGHT COMPANY.

The engine is of 280 B.H P., and the booster delivers at a pressure of 7·2 lbs. per sq. in. when running at a speed of 750 R.P.M.

It was in April, 1925, that we first published an illustrated description of the Michell crankless gas engine and compressor as constructed by Messrs. Crankless Engines, Ltd., of Melbourne. The sole rights for the manufacture of the crankless gas compressor in Great Britain were secured by Messrs. George Waller & Son, Ltd., of Stroud, who in 1926 received an order from the Australian Gas Light Company, of Sydney, for seven boosting sets, each to deal with 500,000 c.ft. of gas per hour, and deliver it at a pressure of 7·2 lbs. per sq. in. when running at a speed of 750 R.P.M. The gas engines for these units are being manufactured by the National Gas Engine Company, of Ashton-under-Lyne. They are also of the Michell crankless type, and are of 280 normal brake horse-power.

For two years the crankless compressor has been running at the Sydney Gas-Works, and has given every satisfaction. Naturally, this success has engendered whole-hearted confidence in the new idea; and it may be mentioned that Messrs. Waller have in hand two large sets for Adelaide, and another for Melbourne, besides a smaller unit for Japan.

ADVANTAGES OF THE CRANKLESS ENGINE AND COMPRESSOR.

Recently a large number of well-known gas engineers were invited to see one of the sets for Sydney running at the works of the National Gas Engine Company; and on this occasion we took the opportunity of inspecting the plant. The immediate impression on viewing the engine-compressor unit was the extraordinarily small space it occupies—a point of first-rate importance with the ever-increasing demands made upon already cramped gas-making sites. The next impression was its smooth running. On account of the motions of the pistons being truly harmonic, and because of their symmetrical arrangement—as will be described later—the total volume of gas which at any instant is being taken in by the pistons on the suction stroke is exactly equal to the total volume which is being compressed and discharged on the delivery stroke. This is of great importance for the smooth running of compressors at high speeds. As a matter of fact, the unit seen at Ashton was merely bolted to a plate. The masses of the slant and reciprocating pistons being correctly adjusted to one another, this type of compressor admits of perfect dynamic balance in all directions, and therefore communicates no vibration to its foundation or to the engine driving it.

As for the efficiency of the machine, this is very high. The volumetric efficiency is 90 p.ct., and the mechanical efficiency 87 p.ct. Also, the high speeds at which these machines can run (varying from 250 to 800 R.P.M., according to circumstances) allow of smaller engines to drive them—a fact which reduces initial cost. Three more important features of the plant must be mentioned. First, the high efficiency is main-

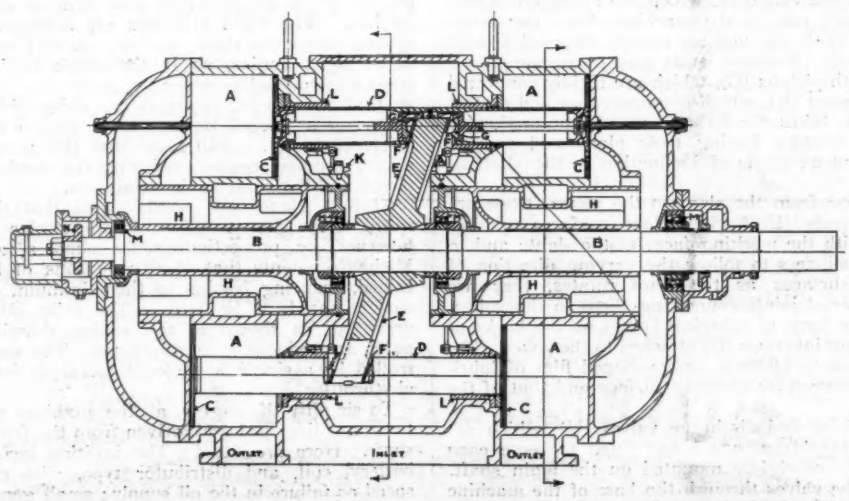


FIG. 1.—SECTION OF THE CRANKLESS BOOSTER MANUFACTURED BY MESSRS. GEORGE WALLER & SON.

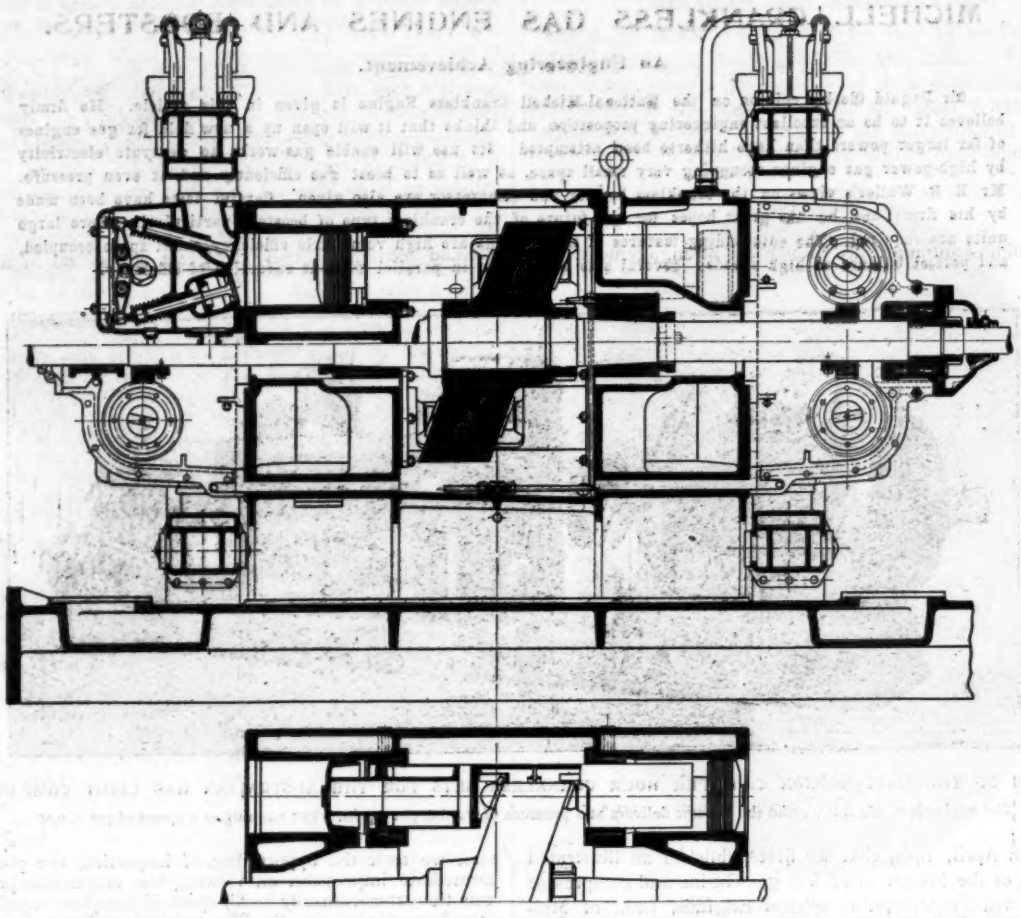


FIG. 2.—CROSS-SECTION OF THE NATIONAL-MICHELL CRANKLESS ENGINE, AND DETAIL OF THE "SLANT."

tained over a large range of volumes and pressures; secondly, two or more of the machines can be run in parallel without their efficiency being reduced; and thirdly, the high speed of the compressor, and the large number of cylinders employed, both tend to give a very steady discharge pressure—a characteristic of strong appeal to gas engineers.

We will now pass on to a detailed description of the combined Michell crankless gas engine and booster. The crankless mechanism has been developed from the same principle as the Michell thrust bearing. By applying a previously unknown dynamic property to the familiar "swash-plate" device, and by designing the swash-plate in a new manner, the inventor has been able to produce a machine which not only converts rotary motion into reciprocating, but, conversely, reciprocating motion into rotary. In the crankless mechanism, the "swash-plate" is termed the "slant."

THE BOOSTER.

The booster under review, a section of which is shown in fig. 1 has twelve double-acting cylinders (A), each 12 in. bore by 9½ in. stroke. These cylinders, which are arranged in two groups of six at each end of the machine, have their axis parallel to the main shaft (B), and are equally disposed around the axis of this shaft. Further, each pair of juxta-opposed cylinders is fitted with pistons (C), which are rigidly connected by yokes (D). The slant (E), which is mounted on and rotates with the main shaft, takes the form of an oblique section or slice of a circular cylinder having truly plane and parallel working surfaces and an angle of inclination to the shaft of 22½°.

To transmit motion from the slant to the yokes, these are fitted with slipper pads (F) having plane surfaces making lubricated contact with the working faces of the slant; and in order to enable the slippers to follow the varying direction of inclination of the surfaces as the slant rotates, they are furnished with universal joints connecting them to the yokes. These joints take the form of spherical bosses on the backs of the slipper pads, fitting into cups (G) attached to the yokes. The slipper operates so as to allow a wedge-shaped film of lubricant to be formed between its working surface and that of the slant.

The distributing inlet and discharge valves (H), which are of the combined rotary type, one being fitted to serve each set of six cylinders, are rigidly mounted on the main shaft. The gas passes to the valves through the base of the machine and passages provided in the body. Delivery is made through the valves and the end covers, and thence into the body of the machine to the discharge branch in the base.

Forced lubrication is provided by means of a pump in the auxiliary pedestal of the engine, which will be described later. A scavenge pump for drawing oil from the slant case and returning it through the cooler to the tank is also provided. The slant is efficiently lubricated from jets (K) impinging oil on its surfaces, from which a copious supply is transmitted to the slippers by centrifugal force. The guides (L) in which the yokes work are positively lubricated; but this system is not extended to the main bearings (M), these being of the "Skefko" type. Any residual unbalanced forces which may act longitudinally on the slant and shaft are taken up by a Michell double thrust bearing and thrust collar (N).

THE CRANKLESS ENGINE.

As mentioned, the engine is of 280 H.P. capacity at 750 R.P.M., and it works on the four-stroke cycle, using town gas. The particular feature of this type of engine is the elimination of the crank, and the substitution in its place of a slant mounted on the main shaft, which also acts as the flywheel of the engine. The eight cylinders are arranged in pairs equally spaced round the slant, and are parallel to the shaft instead of at right angles, as in the crank engine. Each pair of pistons is coupled together by means of a yoke, and arranged so that the thrust impinges on either side of the slant by means of a Michell thrust slipper with a spherical seat. A reference to fig. 2 will show that this arrangement produces a very compact engine, reducing the mechanism between the piston and the shaft to the minimum.

At first glance one would think that the high periphery speed of the slant would make the engine inefficient. It is, however, by proportioning the slippers according to Mr. Michell's patents that ideal conditions of lubrication are obtained, reducing friction to the minimum, and enabling high surface speeds to be used. The valve mechanism is simply arranged, as shown in the section drawing. The moving parts are reduced to a minimum. The engine speed is controlled by a single hand lever operating four sets of gas and air throttles.

To simplify the engine, all the auxiliary mechanism is fitted to an auxiliary pedestal, driven from the free end of the engine shaft. Here are fitted: The ignition gear, which is of the battery, coil, and distributor type, with cut-outs for excess speed or failure in the oil supply; small generator for recharging the batteries; geared oil pumps for engine and booster;

oil scavenging pumps for emptying the engine and booster sumps, and passing the oil through the coolers to the supply tanks; water circulating pump for the engine (the water cooling is arranged on the open circuit, so that the temperature and flow of the cooling water can be easily observed); and the starting gear. The main engine is started by a novel arrangement. A small 12 H.P. three-cylinder crankless engine, which is started by hand, drives reduction gearing by means of a friction clutch on the starting engine shaft and a claw clutch on the main engine shaft, all of which are fitted to the auxiliary pedestal. As soon as the main engine picks up speed, the claw clutch is automatically thrown out of engagement. A limit governor prevents the small engine running away. Incorporated in the starting engine are priming pumps which ensure an instant supply of oil to the main engine and booster at starting.

SIR DUGALD CLERK'S OPINION.

Following the inspection, the visitors assembled for tea. Afterwards Sir Dugald Clerk was asked to describe the gas engine, and Mr. B. B. Waller was invited to deal with the booster.

Sir DUGALD CLERK, after welcoming those present, remarked that the engine they had just seen was one of the most interesting which had appeared in the gas industry for a very long time. The beginning of the possibility of an engine of that kind was found in the use of the Michell thrust block in large ships and in steam turbines. It depended for its action on the arrangement of the block and the position of the pivot controlling it. The result was rather peculiar. The block tilted, but it did so in such a way that there was always a stream of oil passing in at one side between the surfaces, and passing out at the other; and in this way it was always kept lubricated. Theoretically the tilt was rather complicated, but he had occasion to make some experiments in his laboratory in London with a block exposed; and he found by having a revolving mirror that there was a very small tilt, always in the one direction. This made a marvellous difference in the coefficient of friction. As a matter of fact, the friction fell almost to one-thousandth of the pressure, without the faintest fear of any abrasion of the connecting surfaces. As they would understand, this at once made the crankless type of engine possible; and it was interesting—indeed, splendid—to find an engine so built as the one they had just inspected.

The two engines which had been running that day, continued Sir Dugald, were the two largest of that particular type which had been built in the world. Each engine would give about 300 H.P. at 750 R.P.M. The mechanism was exceedingly simple; and the usual precautions which every gas engine builder had to take to ensure that his mixture was correct had been adopted. He was very glad to say that Mr. Bickerton, of the National Gas Engine Company, and the staff, had succeeded in overcoming all the small difficulties which invariably appeared when a new departure was made; and he was pleased to find that both engines were running so well.

He had no doubt whatever that many uses could be made of this engine, and he thought there was a special opening for large engines—very much larger engines than they had so far attempted, and occupying very small space. He felt sure there would be considerable demand and use for this type of engine in the gas industry, and he believed that the same pattern could be employed successfully for generating electricity and for other purposes. In fact, he saw a good field open for this engine with coal gas, water gas, producer gas, coke-oven gas, and also blast furnace gas. All these gases could be employed; and he was certain that much power and economy could be obtained, thus making it possible to use in gas-works large-power engines to generate electricity as well as to boost the gas.

MR. B. B. WALLER'S VIEWS.

Mr. B. B. WALLER, having thanked Sir Dugald Clerk for arranging to be with them that day, said how glad he was to have this opportunity of paying a high tribute to the National Gas Engine Company for the great interest they had taken in this new design, and for the close attention they had given to overcoming the little difficulties which had naturally arisen in producing such a perfect-running engine as they had seen that day. They felt very proud of their efforts; and he was sure that in the near future those efforts would be well rewarded.

He did not wish any of those present to go away with the idea that this was the first crankless gas engine and crankless booster that had been made, or that it had only just been tried out. As most of them probably knew, the talented inventor Mr. Michell was Australian born and lived in Australia; and the birthplace of the crankless design was Melbourne. Mr. Waller said that it was his privilege last year to visit Australia and to meet Mr. Michell there, and to inspect his works and laboratory. He (the speaker) also saw some of the machines which had been made in Melbourne and which had been running for about two years, giving almost continuous service and excellent results. These machines were smaller than the one they had seen that day—about 200,000 c.ft. per hour at the Sydney and the Adelaide Gas-Works, and a smaller one at Footscray, near Melbourne. All these were running exceedingly well. As far as this country was concerned, this was the first effort at production of the crankless machines, following on the experience which Australia had had, and perfecting the designs and ideas.

Sir Dugald Clerk had told them of the gas engine, and had explained it in that lucid manner which they expected of him from his intimate knowledge of the subject. Perhaps the booster side interested his (the speaker's) firm more, because they had the sole licence for the manufacture of the Michell crankless booster and compressor. From the very careful tests that had been made, they had great hopes that in the future it would be a recognized design—more particularly where large units were required.

The outstanding features of this machine were, briefly, its very high volumetric efficiency, which was maintained over a wide range of volumes and pressures; the small space occupied; and perfect balance at high speeds. Unlike most boosters of the fan type, it would maintain a constant pressure at varying volumes; and several sets could be run in parallel without reduction in efficiency.

EXTENSIONS AT SPALDING AND NEWMARKET.

The Spalding Urban District Council have placed an order with the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., for a further installation of Woodall-Duckham continuous vertical retorts. The new installation will comprise six unit retorts, and will be arranged in an existing horizontal retort house. It includes the necessary coal and coke handling plant, and is arranged so that a waste-heat boiler can be added at a later date.

This is the second Woodall-Duckham continuous vertical plant to be erected at Spalding. The Ministry of Health, who have held an inquiry into the matter of these gas-works extensions, have now given their sanction to the raising of the necessary loan by the Council.

The Newmarket Gas Company have also placed an order with the Woodall-Duckham Company for an installation of "W-D" continuous verticals. This installation comprises six unit retorts. The plant will be complete with coal and coke handling plant and waste-heat boiler, and will be similar in all respects to the plant recently erected and put into successful operation for the Wisbech Lighting Company. This plant was described in the "JOURNAL" for April 20.

"Flame and Combustion in Gases."—This is the title of a new book by W. A. Bone and D. T. A. Townend, which has been published by Longmans, Green, & Co., Ltd., at 32s. net. A review will be published shortly in the "JOURNAL."

Large Gasholder Construction in the United States.—The Stacey Bros. Gas Construction Company, of Cincinnati, are erecting a 10 million c.ft. standard telescopic type gasholder at Long Beach, California. This holder is approximately 270 ft. in diameter by 280 ft. high, and nearly 5000 tons of steel are involved in its construction.

"Income-Tax Up-to-Date."—A summary of the principal changes in the new Finance Act is included in the 1927-28 edition of Mr. H. J. Gully's "Income-Tax Up-to-Date," which is published by the "Financial News," 111, Queen Victoria Street, at 9d. net. This useful little booklet explains clearly and simply the subject of its title.

Gas Growth in Chicago.—In Chicago the increase in gas consumption has exceeded population increase every year. Total sales to relatively small users increased 5 p.ct. in 1926. Sales for house heating show a remarkable growth: From 305 million c.ft. in 1924, to 600 millions in 1925, and 1020 millions in 1926. More than 1500 Chicago homes have gas-fired central heating plants.

Midland Junior Gas Association.—A meeting of the Association will be held on Thursday, Sept. 1, at the Council House, Birmingham, at 6.15, when the Hon. Secretary, Mr. W. L. S. Spinks, will outline the revised regulations of the Institution of Gas Engineers' Education Scheme. The President of the Midland Association of Gas Engineers and Managers (Mr. F. C. Briggs) will be in the chair; and opportunity will be given for those present to state their difficulties.

Royal Sanitary Institute Awards.—The list of awards of the Royal Sanitary Institute in connection with the Congress and Exhibition at Hastings this year includes silver medals to Messrs. Chance Bros. & Co., Ltd. (laboratory glassware), Messrs. Sidney Flavel & Co. ("Leamington" gas cooker), the Hastings and St. Leonards Gas Company (gas cooking and heating appliances), and the Ruud Manufacturing Company, Ltd. (automatic gas instantaneous water heaters). The last-named Company also received a bronze medal for an automatic gas cut-off. The British Sa-Vall Company's "Cookall" gas cooker was commended.

IRISH ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING.

The Annual Meeting of the Association was held yesterday in Cork, under the presidency of Mr. Joseph McNicholl, M.I.Chem.E., Engineer and Manager of the Cork Gas-Works. His address follows. Other contributions to the meeting included "Concrete Roads and Streets," by Mr. W. Millar, of Cookstown, and "Some Notes on Sulphate of Ammonia and the Manufacture of Liquid Household Ammonia as an Adjunct to a Sulphate of Ammonia Plant," by Mr. G. Walmsley, of the Londonderry Gas-Works; and Mr. W. M. Mason gave an address on "Publicity." Mr. Walmsley's and Mr. Mason's papers are also published to-day; and Mr. Millar's contribution will appear next week, together with our report of the whole proceedings.

PRESIDENTIAL ADDRESS

of Mr. J. McNICHOLL, M.I.Chem.E., of Cork.

COAL STRIKE.

When we last met together twelve months ago, the strike of the British coal miners was in full swing, and the subject which occupied most of our attention was that of coal supplies. The situation became much more serious in the succeeding months; but, though many works were on the point of being closed down, with one or two exceptions they managed to keep going, and in addition to meeting the normal—and in most cases abnormal—demands for gas, were able to render important assistance in relieving the distress caused by the scarcity of solid fuel. This is not the first time the gas industry has helped substantially to cope with the problem of light, heat, and power supplies at a critical period. Once again the industry has been given the opportunity of demonstrating in a small way its vast importance and usefulness, and once again it has risen to the occasion. I say "in a small way," because the services rendered at a crisis such as this are small compared with those being rendered continuously by the utilization of an important raw material to the best advantage, and the manufacture of products essential for the well-being of every civilized country. In Ireland it would be difficult to overstress the importance of an industry which is the only source of these products.

It is always of interest to obtain first-hand information of the production of coalfields hitherto unknown to us; and to the coal stoppage may be given the credit for enlarging our experience of the world's coalfields. It would, however, be a case for gratification rather than regret if we were never given the opportunity of becoming acquainted with much of the material which was sold as coal at that time by many Continental firms. Some of the coals received from this source in the early months of the strike were fairly satisfactory; but as time wore on, the cargoes received not only for gas, but for general purposes, rapidly deteriorated. They were seldom, if ever, up to specification, and in addition were almost in every case considerably short in weight. On the other hand, it is a pleasure to join in the practically general chorus of appreciation of the supplies received from the American coalfields. Our experience in Cork with coals from this source was very favourable indeed. Some of the coals were of excellent quality, as good as any I have had the privilege of carbonizing.

If the lessons of that disastrous period have been properly assimilated by those immediately concerned, such a stoppage could not occur again for at least another generation. It would, however, be extremely unwise to take this for granted when outlining our future policy. I am afraid it will still be necessary to maintain large stocks of coal, especially in this country, where strikes in other quarters might cut us off from our source of supply. It is the only satisfactory form of insurance open to us, though the premium—if the interest on the capital sunk may be viewed in that light—is an exceedingly high one.

LOOKING FORWARD.

I do not consider we need anticipate any reduction in the demand for gas as a result of the development, and possibly the cheapening, of other forms of energy. The demand for gas in the United States of America has increased along with the demand for electricity, until the consumption *per capita* in each case is very much higher than in any other country. This fact has often been quoted as an example of what may be expected when the large schemes of electrification in the British Isles are under way. This, I think, is the correct view to take, especially by those engaged in the more progressive gas undertakings; but for those whose plant and methods of business do not reach a reasonable standard of efficiency, this view may prove to be a foolishly optimistic one. A few small gas undertakings have gone under without any solid excuse in the nature of keen competition; and one is forced to the conclusion that the affairs of such gas-works must have been very badly handled for many years before they were obliged to close down.

In my opinion it will be a long time before the super-power station scheme in England or the Shannon power scheme in Ireland will result in cheaper current being available. One has only to consider the number of power stations already in existence which will have to be scrapped or retained for use in case of emergency, to realize that the immediate effect, if the schemes are worked on strictly business lines, will be an increase in price to cover the additional capital charges. Possibly the saving in cost of generation will in time go a long way to meet these charges. This is what may be expected in England. With or without super power stations, improved working will eventually bring about cheaper current.

It is, however, difficult to see how the user of electrical current in Ireland is going to benefit, even if the figures given in the experts' report on the Shannon scheme do not prove to be far out of truth. These gentlemen estimated that the working costs per KW.H. will be 0·41d. at the bus bars of the Shannon Power Station, 0·51d. delivered at the 100 KV. transformer stations, and 0·92d. at the 35 KV. stations. These are minimum figures based upon estimates prepared by the Contractors

THE PRESIDENT,
Joseph McNicholl, M.I.Chem.E., Engineer and Manager of the Cork Gas-Works.

(Messrs. Siemens Schuckert), with a slight addition which the experts thought necessary. If they were to go into the matter again, even at this stage, I am sure they would find there were other important items of which no account had been taken in preparing the estimates. Assuming, however, it were possible to deliver current at the Cork transformer station, which I presume will be erected somewhere on the north-west boundary of the city, at the higher voltage figure, the cost at the power station, after making due allowance for transformer losses, leakages, &c., would not be much less than ¾d. per unit. If the current were delivered at the lower voltage, the cost would be well over 1d. per unit. These figures correspond to the cost of generation, and considered as such are not particularly low. They would be thought high for a modern steam installation; and there are many stations only moderately up-to-date manufacturing at lower figures. When the costs of distribution, &c., have been brought into the account, it will not be surprising if it is found to be impossible to supply current as cheaply as at present.

The cost of current in the small country towns where distribution systems have yet to be installed will naturally be much higher than in the cities. In such cases anyone with a fair industrial load will be able, with the aid of an oil or a suction gas engine generating set, to provide himself with current at a lower rate than that of the State current, especially if the surplus heat of the engine can be utilized in the industry.

I do not wish these remarks to be taken as an attempt to criticize the Shannon scheme adversely. That is not my intention or desire. As a matter of fact, I consider there is no reason to doubt that it will be successful from an engineering point of view; and I sincerely hope that it will also be economi-

cally successful. I am examining it merely from the important point of view of the prospective consumer, who is most concerned about the price at which he will be able to obtain current. There can be no question as to the importance of this point to everyone concerned, and it is naturally of interest to the gas industry. Its importance to industries in general may, however, easily be overstressed. Power and lighting costs together form a comparatively small item in most industries; and I am afraid it will be found necessary to deal drastically with other items in the bills of costs if our industries are to flourish.

Personally I have great admiration for the courage and determination which have been shown by the Government since the matter was taken in hand. Any rational person could not fail to see that eventually the scheme will be of enormous benefit to the country. In the first place it will be responsible for a considerable reduction in the amount of coal imported into the Free State; and if we take as a basis for our calculations the figures for future consumption of current as visualized by the experts, we can form a fair estimate of what that saving will amount to. It has been assumed that the annual output of current from the Shannon will reach 100 million units by 1932. If this current were generated, as at present, by steam plant using (say) 2 lbs. of coal per unit—*i.e.*, at an over-all thermal efficiency of about 12 p.ct.—the amount of coal required would be approximately 90,000 tons per annum. It has also been assumed that the annual consumption will eventually reach 150 million units—*i.e.*, 50 units per head of the 3 million population of the Free State. On the same basis as before, this would require a consumption of 135,000 tons of coal per annum.

These figures are not very significant when viewed in conjunction with the huge scheme which is necessary to effect this saving; but if a supply of current at moderate rates all over the country serves to increase the efficiency of the largest industry —agriculture—imports may be reduced and exports increased in other directions. Also, with surplus current available it may be practicable to establish electro-chemical industries for the manufacture of synthetic nitrogenous fertilizers, though the experts were of opinion that the price of current would be too high for the success of such an industry. Ireland as an agricultural country uses large quanties of artificial fertilizers, the bulk of which have to be imported. It is obvious, therefore, that such an industry would be a great asset.

As gas engineers it will give us a better idea of the Shannon scheme as a whole if we consider its estimated output in terms not of electrical units, but of heat units or therms. It will be a long time before the annual consumption of electric current in the Free State reaches 150 million units. This in terms of heat units is equivalent to 5 million therms per annum.

The annual output of the Cork Gas Company in the form of gas alone is not far short of 2 million therms, and the output of the Dublin Gas Company is about 9 million therms. A moment's reflection on these figures would clarify the view of those who imagine that gas will be superseded by electricity to any appreciable extent. Before this can happen it will be necessary to supplement the Shannon scheme with another much larger source of power. If this were possible, gas would still be able to hold its own on the grounds of utility and economy.

My object in endeavouring to point out why there is no immediate, and not even a remote, possibility of our having to face competition much keener than at present is not that we may excuse ourselves for taking things easily. I know of no industry or profession which can afford to adopt an easy policy; and it is well that it is so, since progress and development do not arise entirely from peaceful study and investigation, but in large measure from the efforts of the individual worker to improve and expand the industry from which he obtains his living, incidentally or otherwise, that he personally may as a result of his achievement reap a reward in the shape of renown or means for a higher standard of living. In short, the old adage "necessity is the mother of invention" may be applied with greater truth than ever to the industrial world of to-day.

Cheaper Gas.

In my opinion the most important move we, as an industry, are called upon to make is in the direction of cheaper gas; and I shall ask you to consider with me some of the steps by which we may hope to progress towards our objective.

Much has been done during the last ten years to lower the cost of gas production by increasing the thermal yield of gas per ton of coal; and it will probably not be long before we reach the limit in this direction. There is an economic limit for every type of plant, which, of course, varies with the quality of coal. Recent progress has been the result of improvements in the design of retort settings, and in the quality of refractory materials which have enabled us to carbonize at higher temperatures. Yields of over 70 therms of straight coal gas are being obtained; and I believe it is possible to obtain over 80 therms. It is doubtful, however, whether the large yield would justify the extra expenditure on upkeep and control necessary to obtain it. With the use of steam very much higher results can be obtained, but it would be a grave mistake to regard all extra therms obtained in this way as clear gain.

So long as the increased yield is obtained without appreciably sacrificing the yield, and—what is of more vital importance—the quality of the coke, I believe it is sound practice to strive for the highest possible yield of gaseous therms; but any increase in the latter which involves a smaller yield of coke, and that of poorer quality, is, in my opinion, too dearly purchased. The percentage of ash in the best-quality coke is high when compared with that in the best-quality coal; and any practice which increases this discrepancy is obviously unsound, except, of course, in cases where there is a suitable outlet for such coke.

If the results of tests which were carried out with Wigan Arley coals to determine the effect of steaming in verticals on the ash content of the coke [see "JOURNAL" for Nov. 7, 1923, p. 378], are conclusive, it would appear that the effect is *nil*, or at any rate not appreciable as far as the coke is concerned, and that all the ash associated with the carbon consumed finds its way into the smalls or breeze. The results would not be surprising if all the ash in the coals we are called upon to deal with were part of the coal substance; but my experience with coals, including Wigan Arleys, has convinced me that the bulk of the ash in coke is not from the coal substance, but from the foreign material mixed with the coal. If any sample of coke is carefully examined, a microscope is not necessary. Fragments of the foreign material alluded to will be found embedded in it; and as steaming would not be likely to effect any change in this, it is only natural to conclude that, as steaming progresses, the proportion of this material, chiefly ash, to the whole would increase.

Many experiments have been and are being carried out with the aim of improving the quality of coke. It is perhaps not strictly correct to put it this way, as the object of the experiments is really to alter by blending or otherwise the physical structure of the coke so that it can be ignited more readily, and thus made suitable for any class of household grate. I feel confident that the gas industry will eventually be able to provide a smokeless fuel which will be used in preference to coal for domestic and many other purposes. Were it not for the difficulty in igniting coke as at present made, it would doubtless be more in demand than coal; the entire absence of smoke and soot when it is used, and its very much higher ratio of heat radiating surface to weight, being powerful factors in its favour.

Tar.

Coal tar is generally acknowledged to be one of the most useful, as it is certainly one of the most wonderful, products with which the chemists of the last century have been called upon to deal. It is generally taken for granted by those who have a little knowledge of its vast utility that it is a great source of revenue to the gas industry; but it is a sad fact that until recently, when its use on the roads became general, the revenue from the sale of tar was a comparatively insignificant one, except on works favourably placed, such as small ones with a ready sale for general purposes, or very large ones with complete distilling and refining plants. Possibly when the uses of tar and its products are further explored and exploited, this commodity will exercise a more potent influence in reducing the net cost of gas.

Ammonia.

The bulk of the ammoniacal liquor produced by gas-works is utilized for the manufacture of sulphate of ammonia. At the present time, owing to the high price of acid, high labour costs, and the low selling price of the finished product, the balance of profit on its manufacture is very small indeed. I cannot see any prospect of improvement in the position. The world's production of nitrogenous fertilizers is increasing more rapidly than the demand, and will doubtless go on increasing as long as the synthetic processes can be worked at a profit—and possibly longer.

As it is useless to hope for better prices in the near future, the only means left of increasing the net revenue from this source is by economies in manufacture. These may come from cheaper raw materials or lower labour costs; but I think they will eventually be the result of the substitution of some method other than the use of sulphuric acid for the fixation of the ammonia at our disposal.

I hope I shall be excused for repeating the oft-quoted statement that there is sufficient, or more than sufficient, sulphur recovered in the gas industry to manufacture all the sulphuric acid required to convert the ammonia from the same source into sulphate. There are many gas-works to-day independent of outside supplies of acid; but the manufacture of sulphuric acid is a process that can only be adopted with success in large works, and in such cases it is not always possible or desirable to introduce the process. I think that, however difficult it may seem at present, we shall not have very long to wait for a successful process for the direct combination of sulphur and ammonia. Several attempts have been, and are being, made to achieve this end; and success is claimed for at least one process—the Burkheiser, which has been tried on a working scale. This process is, however, an ambitious one; the object of its design being to revolutionize existing methods of purification, with the formation of sulphate of ammonia by direct combination of sulphur dioxide and ammonia, and subsequent oxidation as part of the process. I should like to see a less

ambitious attempt made to manufacture sulphate of ammonia by the direct combination of ammonia distilled from ammoniacal liquor with sulphur dioxide from spent oxide. This would not be very difficult to accomplish if the ammonia were not associated with other gases; but this difficulty is not, I think, an insuperable one. Such a process would probably be no more complicated than that of sulphuric acid manufacture, and should be less of a nuisance than the latter.

SERVICE.

It is very difficult to over-estimate the importance of being in a position to sell gas at a low price, but it must be realized that cheap gas alone is not sufficient to ensure the success of any gas undertaking. If consumers are not able to obtain all the gas they require at a reasonable pressure and of uniform quality, the services given may be considered too dear at any price. Even when everything up to this point is in perfect order, it is still not sufficient. I confess to being unable to add anything new to what has already been written to emphasize the importance of the services required beyond this point. This subject has been receiving increased attention of late from every Institution and Association connected with the industry; and whatever may have been the case in the past, I think there is now no danger of its importance being in any way underrated.

GAS ENGINES.

It is generally agreed that gas apparatus has on the whole reached a high degree of efficiency; and doubtless we cannot hope for much higher efficiencies than are now being obtained. The same process has not been made in recent years in the design of the gas engine, though some advance has been effected in the construction of the larger units. The over-all thermal efficiency of the gas engine of to-day is little, if any, higher than it was twenty years ago, and little has been done since then to simplify or lighten its construction. If the builders of gas engines had only the gas industry to rely upon for the absorption of their output, it is possible that the smallness of the demand would have spurred them on to greater endeavours; but the dimensions of the suction gas and the oil engine business have dwarfed into insignificance that of the engines required for town gas. The principal firms would probably protest that that has not been, and is not at present, their view of the matter, but the fact remains that they have done little to help us to meet the growing competition for power loads. The high price of gas engines compared with electric motors of the same power is a decided handicap, as is also the high price charged for parts for renewal. The price quoted for a new piston and liner has been enough to scare many gas engine users into making other arrangements for power. The manufacturers' obvious retort to this would be that there is little difficulty in maintaining power loads where the gas is sold at a specially low rate for this service; and I do not think they would have much trouble in proving the point. I have already stressed the importance of cheap gas; and the question of a more scientific or business-like differentiation in our scales of charges is now receiving the attention of the industry.

Until comparatively recently the internal combustion engine was supreme as a heat engine—that is to say, its over-all thermal efficiency was greater than that of any other prime mover. It is probably still supreme, but this supremacy has been seriously challenged by the modern steam turbine with high-pressure steam. In 1924 Sir Charles A. Parsons quoted the following over-all thermal efficiencies—*i.e.*, from fuel to electricity—generated in a turbine installation. With steam pressure of 250 lbs. per sq. in. superheated to 750° Fahr., 26·5 p.ct.; with steam pressure of 2000 lbs. per sq. in., superheated to 750° Fahr., 30·75 p.ct. These efficiencies are equivalent to 0·501 and 0·432 lb. of oil respectively per B.H.P. hour—as good as the best in oil engines. It will, however, give the present audience a better idea of the achievement when it is pointed out that, to obtain similar efficiencies in a gas engine, the consumption of 500 B.Th.U. gas per B.H.P. hour would be only 19·5 and 16·8 c.ft., respectively.

The above efficiencies are only possible under ideal conditions; and power station engineers are by no means unanimous in recommending the installation of high—or what may be termed super high—pressure steam plants. Steam boilers for pressures over 250 lbs. per sq. in. are necessarily of special tubular design. The higher the pressure, the smaller must be the diameter of the tubes. Steam has actually been generated on a small working scale at a pressure of 3200 lbs. per sq. in., at which critical pressure the latent heat is *nil*—*i.e.*, the exchange from the liquid to the gaseous state takes place without any change in volume; but I think it is extremely unlikely that we shall hear of any installations of that type. High efficiencies can be too dearly purchased; and I think it is reasonable to assume that the practical limit of the over-all thermal efficiency of steam installations is from 27 to 30 p.ct., whereas it is not too much to expect that the efficiency of the internal combustion engine will reach, and possibly exceed, 40 p.ct.

Town gas, however, is not often in competition with steam; and my object in referring to the great advance in the efficiency of steam plants in conjunction with the steam turbine is to contrast it with that made in the internal combustion engine. The most important development of the latter is that of the Diesel type engine—a very important one from the point of view of the manufacturers. The large experience gained with this type has not, however, so far as my knowledge goes, enabled the makers to improve the gas engine. I have not heard of any attempt having been made to adapt the best features of the Diesel engine—*i.e.*, high compression and self ignition—to the gas engine. The main difficulty, I presume, is the injection of fuel (gas) into the cylinder. Another direction in which, I think, we are justified in looking for improvement is towards engines of lighter construction. The all-steel engine is bound to come; and the sooner it comes the better. Its development is probably dependent more on the steel manufacturer than the engine builder; but the latter must supply the incentive. The gas turbine has already arrived, but only in one sense is it anything near expectation—that is, in lightness of construction. I understand that the Holswarth turbine is less than half the weight of a reciprocating engine of the same power; but unfortunately its over-all thermal efficiency is not much more than half that of the reciprocating type.

I am running the risk of being considered presumptuous when I venture to predict that the lines on which the development of the turbine will eventually succeed will be in the combination of the steam turbine with an internal combustion boiler in one unit, with fuel, air, and water at high pressures—the water to be injected in the form of a spray for the purpose of temperature control. I am aware that from a purely theoretical point of view the combination of permanent gases and steam is not very promising, but I think it has possibilities which have not yet been fully investigated. With this, as in fact with any turbine, the main difficulty in the way of obtaining efficiency lies in the power absorbed in compressing the charge; and, of course, with or without steam, condensers are out of the question.

I consider the problem of the development of the internal combustion engine is one of the most important that confronts the gas industry to-day. It is at least of equal importance as a subject for research to any of those now receiving the attention of the Institution of Gas Engineers. In this case, however, mere laboratory research would not be sufficient; and I do not think this branch of the subject has suffered so much from neglect. What is required is the wherewithal to conduct experiments on a works with every constructional facility at command; and this, I am afraid, would be considered beyond the means of any of the bodies associated with the gas industry. Perhaps the Society of British Gas Industries could be induced to adopt it as a subject for joint research.

FUEL RESOURCES OF IRELAND.

The amount of coal mined in Ireland amounts to a very small fraction of her needs; and I believe there is none of the rich bituminous variety required for gas-making. There is, however, a plentiful supply of peat fairly widely distributed over the country; and I should not be surprised if, when the Shannon scheme is under way, a serious attempt is made to establish the peat industry on a large scale either in conjunction with the Shannon scheme as an additional or alternative source of power, or with the object of placing a good class of peat fuel on the market. Hitherto, this has not been looked upon as a sound economic proposition; and when one considers the nature of the difficulties to be overcome, this is not to be wondered at. The chief difficulty is the enormous proportion of water contained in the newly-won peat, which is as high as 95 p.ct. in some districts. Apart from the peculiar difficulty of drying to any extent, the heavy cost of handling so much useless water is a serious obstacle. This is not the place to discuss this aspect of the question; and anyone who is interested in the subject can obtain a fund of information from the literature published by the Department of Scientific and Industrial Research.* Its interest from our point of view lies in the possibility of our being able to utilize the peat, if and when available, in the gas industry. As you are aware, air-dried peat has been carbonized on a small scale in experimental retorts at the Fuel Research Station. The report of the results obtained is very interesting, but it could not by any stretch of imagination be described as promising to anyone on the look-out for a substitute for gas coal. It would doubtless be sounder practice to utilize the peat for the manufacture of producer gas.

If ever peat is marketed as fuel on a large scale, I believe it will be in the form of briquettes; and these will probably be somewhat similar in appearance and composition to the brown coal briquettes made familiar to us during the coal stoppage. I am indebted to Dr. E. W. Smith for samples of briquettes made from peat in what I understand to be an experimental plant in Dumfries. These are in some respects similar to the brown coal variety, but are of better appearance, and on analysis prove to be much better in one important particular—the content of sulphur in the briquettes made from peat was very low, only 0·20 p.ct.; while in those made from brown coal it

* Lecture by Prof. Purcell before the Dublin Society in 1919 on "The Peat Resources of Ireland."

Report of the Fuel Research Board, 1921—"The Winning and Use of Peat in Ireland."

varied from 3 to over 4 p.ct. Possibly this high sulphur content may have some bearing on the liability of the latter to spontaneous combustion.

Analysis of Peat and Brown Coal Briquettes

—	Peat.	Brown Coal.
	P.Ct.	P.Ct.
Volatile matter, *less* moisture	66·35	60·62
Moisture	5·00	5·89
Ash	5·15	4·98
Fixed carbon	23·50	28·51
	100·00	100·00
Sulphur	0·21	4·12

We have carbonized brown coal briquettes in our coal testing plant; and a typical result is given, together with the result of a test on a good-class Durham coal. The retort is of cast iron, and carbonizes a charge of 11·2 lbs. of coal. The temperature of carbonization was about 1020° C., as measured with a "Wedge" pyrometer. The results are given below.

Yield per Ton.

—	C.Ft.	Calorific Value, B.Th.U.	Therms.	Time of Carbonization, Minutes.
Coal	14,620	527	77·05	60
Briquettes	19,800	402	79·60	40

The coke from the briquettes was practically useless, and the tar appeared to be similar to that described in the report of the Fuel Research Board on the carbonization of air-dried peat. It could not be dealt with satisfactorily in the plant at present in use in gas-works. I have carbonized coal with a small percentage of peat in this test plant with very good results—as regards yield in gaseous therms. The coke from the blended samples was also more easily ignited, but in my opinion this advantage would be discounted by the softer nature of the coke. It would be of interest if the Research Sub-Committee of the Institution of Gas Engineers were to include peat or brown coal briquettes in the list of substances to be used in their experiments on blending. It is possible that even a small percentage of briquettes would give trouble in the tar mains, and it might also have an adverse effect upon the value of the tar.

I have also gasified a few tons of brown coal briquettes in a Tully gas plant (capacity 300,000 c.ft. per 24 hours) with fairly good results. We had not sufficient briquettes for a prolonged test, and I hesitate to quote the results obtained, as the conditions were not good enough for reliable experiments. The gas from this plant is not metered, and the only means of estimating the production is by working direct into the relief holder, and noting the rise. I consider, however, that there would be no difficulty in obtaining a yield of 120 to 130 therms from one ton of briquettes.

I have alluded to these tests because I consider they would be of interest to an audience of gas engineers. At the same time I recognize that many more tests on a much larger scale will have to be performed before a conclusive verdict on the utility of peat from our point of view can be given. My object will be achieved if they elicit the interest of others who may be tempted to probe further into the question.

In addition to our solid fuel requirements, a substitute for petroleum products will have to be provided not only in Ireland, but in most countries, for the increasing number of internal combustion engines which are being brought into use. Petrol alone, for use in Great Britain for the year 1926, cost over 21 millions sterling; and it is staggering to think what the annual bill will be ten years hence, if there is then sufficient to meet the demand. Apart altogether from the cost, the limited supply of petroleum will render the provision of a substitute absolutely necessary. I do not know whether anything is being done in this country in preparation for this emergency, but if not, I feel sure that this must soon be remedied. There are, I understand, processes for the conversion of cellulose into fermentable sugars for the production of alcohol. If these reach the practical stage, Ireland should be able to hold its own in the production of an alcohol for power purposes, in addition to the other forms of alcohol for which it is famous, from the waste of the beet sugar industry and other sources.

I fear I have trespassed on your time and taxed your patience by making you travel over so much ground with me. I am conscious of having dealt somewhat superficially with many important subjects, but, as I have already hinted, my chief object is to rivet attention on certain phases of the subjects treated, in the hope that others with more time and ability than I may be induced to give them the attention which they deserve.

SOME NOTES ON SULPHATE OF AMMONIA

AND THE MANUFACTURE OF LIQUID HOUSEHOLD AMMONIA AS AN ADJUNCT TO A SULPHATE OF AMMONIA PLANT.

By G. WALMSLEY, of Londonderry.

The downward trend of sulphate of ammonia prices occasions no little anxiety to those in charge of gas-works at the present time. Until recently, managers in charge of gas-works having sulphate plants, and particularly of the smaller works, could show marked financial advantage by means of this, at one time, valuable source of income, over those in charge of similar sized works who had to dispose of their ammoniacal liquor as such in the best way possible. Now, however, the world's markets are flooded with sulphate of ammonia produced synthetically, and this method of production is only in its infancy. It is thus apparent that, unless the demand for sulphate is increased—and there is yet considerable scope for what might be termed more intensive cultivation, with attendant increased production—by means of a far more general use of artificial manures, or the cost of producing the bye-product sulphate is greatly reduced, soon, instead of "Ammonia Products" appearing on the credit side of the revenue account in a gas undertaking's balance-sheet, the net loss on sulphate or ammoniacal liquor will, perforce, appear on the other side—if costs are properly apportioned—as an item of expenditure. It will be merged under the heading "Cost of Manufacture," or, perhaps, better designated "Cost of Purification."

The author does not, however, take such a pessimistic view as some regarding the future price of sulphate; and though not denying the possibility of a still lower price operating in the near future, he thinks we shall have then about reached the bottom. For, after all, the synthetic process must have heavy overhead charges and production costs peculiar to its own methods to meet, as has any other process. Sulphuric acid, of course, represents a heavy charge against cost of sulphate production; and if the price of the acid usually employed for sulphate making was reduced, or substitutes such as gypsum or nitre cake could be successfully used, together with—perhaps what is of more importance—the cutting-down of production and distribution costs, the bye-product sulphate would still compete successfully with other processes, and show a reasonable profit. In connection with the cutting-down of production and distribution costs, an article recently contributed to the "JOURNAL" (June 15, p. 686), describing a modern plant installed by the Chemical Engineering Company at the Derby Gas-Works, is well worth perusal.

The question of producing concentrated liquid ammonia direct from gas liquor, in conjunction with sulphate of ammonia, in this way dispensing with the use of sulphuric acid so far as regards the production of ·880 ammonia is concerned, might also be profitably considered. The greater the demand found for the liquid product, the less ammoniacal liquor would be left for working-up into sulphate of ammonia, with a corresponding reduction in the amount of sulphuric acid required. Possibly this combination—*i.e.*, a combined concentrated liquid and sulphate of ammonia plant, whereby one or the other of these products can be produced at will, according to the requirements of the engineer—will be the most suitable means of meeting the present difficulties. The existing sulphate stills are available for either system. Special provision, of course, will have to be made for removing the impurities from the crude ammonia leaving the ordinary sulphate still when the production of pure ·880 ammonia is required.

PRODUCTION OF HOUSEHOLD AMMONIA FROM SULPHATE OF AMMONIA.

The present contribution, however, is brought forward with the idea of suggesting a means of raising additional revenue from the existing sulphate plants by a relatively small addition to capital expenditure, compared with that required for the production of concentrated ammonia direct from gas liquor; the object here being to convert some of the sulphate ordinarily produced into liquid "household" ammonia of about 10 p.ct. to 12 p.ct. strength. This, of course, does not dispense with any sulphuric acid required; but by using the sulphate of ammonia as the medium for producing the liquid ammonia, the expense of installing apparatus for purifying the crude ammonia produced direct from gas liquor is obviated.

This system is not brought forward with any idea of claim-

ing it as a novelty, for it is well known to the author that for many years the Chemical Engineering Company, and, no doubt, other such firms, have installed plants in different parts of the country for this express purpose. Indeed, as in the case with the plant installed by this Company at the writer's works some years ago, such plants are erected in many works as part of the sulphate installation as a whole, primarily so as to provide a supply of liquid ammonia for neutralizing the "free acid" content of the salt in the centrifugal prior to final drying.

Providing sufficient demand could be found for this 10 to 12 p.ct. household solution, the present worry regarding the financial aspect of disposing of ammoniacal liquor would, so far as gas-works provided with sulphate plants are concerned, be at an end, for it would pay to transform all the sulphate made into household ammonia, which would produce additional revenue equivalent to £50 per ton of sulphate.

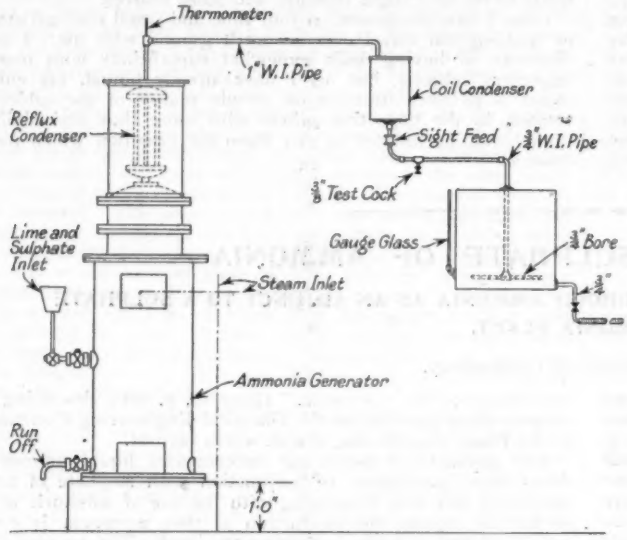
I should state here, however, that so far our own experience regarding the demand for this product has been disappointing; and before contemplating incurring even the comparatively small capital expenditure involved, as an extension to an existing sulphate plant, one should first of all sound the local chemists, wholesale grocers, laundries, &c., as to prospective demand.

The process consists of liberating the fixed ammonia contained in sulphate by adding a certain amount of lime, and heating up in a small steam-heated still; the reaction being as follows:

$$(NH_4)_2 SO_4 + CaO = 2NH_3 + CaSO_4$$

The resultant calcium sulphate is of no value, but the ammonia driven off is condensed, and the liquid product then collected in a special container.

The general arrangement of the plant made by the Chemical Engineering Company, and details of the bubbling section of the still, are shown in the accompanying sketches. The



General Arrangement of Liquid Ammonia Plant.

still, the bottom section of which is 2 ft. in diameter by 4 ft. deep, is somewhat similar to an ordinary ammoniacal liquor still heated by a dry steam coil, and is designed to split-up the sulphate of ammonia by means of the addition of lime. A definite quantity of sulphate of ammonia—in our case usually about 14 lbs.—is saturated with water in a tank, and the resultant sulphate solution is then poured into the still through the charging funnel shown in the drawing. A similar quantity of lime is added. Though theoretically only about half the quantity of pure lime would be required, it is better to err on the safe side, as the ordinary lime is not usually 100 p.ct. CaO. Steam is admitted to the still, as shown in sketch; also provision is made for admitting live steam at intermittent periods for mixing and agitating the sulphate and lime solutions.

The upper portion of the still consists of a series of bubbling trays and overflow weirs through which the ammonia gas has to force its way, as in an ordinary still. It then passes through a reflux condenser and a condensing coil, through a sight feed, from which it is conducted to the receiver fitted with a gauge glass for indicating the level, as shown in the sketch, whence it is run off into bottles for sale. A certain portion of the ammonia gas condenses out in the liquid, and this runs back through the seals and is then split-up again on coming in contact with the steam coil in the still. The ammonia gas is again driven forward; and this process continues until the charge is spent.

As previously mentioned, a charge of about 14 lbs. of sulphate is put into the still. This is worked-off in about two hours, giving some 3 to 4 gals. of ammonia solution.

The operation of looking after the liquid ammonia still is attended to by the operator in charge of the sulphate plant whenever an opportunity permits; and in this way extra labour charges are eliminated.

The strength of the liquid ammonia is, of course, determined by the usual titration test by means of standard acid solution, and is adjusted accordingly.

The financial results accruing from the working-up of (say) one ton of sulphate are as follows:

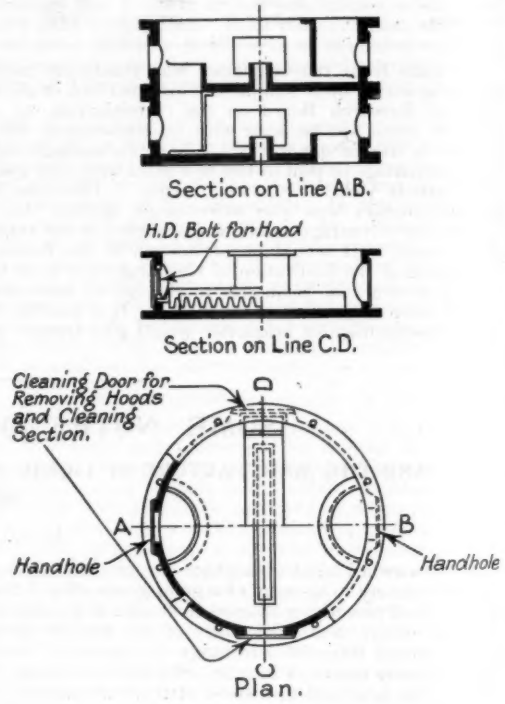
Expenditure.

	£	s.	d.
Sulphate, 1 ton	12	4	0
Lime, 1 ton	1	16	0
Interest and depreciation (say) 10 p.ct. on approximate capital expenditure of £150	15	0	0
Bottles, corks, and labels, 6000 at 3d.	75	0	0
Proportion of sulphate plant, operator's wages, and steam	5	0	0
	£109	0	0

Revenue.

6000 bottles of ammonia at 6d. = (average price received)	160	0	0
Leaving a balance profit for every ton of sulphate converted into household ammonia of	£51	0	0

The above price of 6d. per bottle is an average price received, and covers also the amount sold in larger quantities to wholesalers. The present price of the well-known and largely



The Bubbling Section of the Still.

advertised product "Scrubbs" household ammonia, is 1s. 4d. per bottle; and if by similar or other publicity methods the claims of the local product could be brought before all gas consumers—by (*a*) local Press advertisements, and co-operation with local chemists, grocers, &c.; (*b*) circulars sent out with gas accounts, and distributed through the showroom; (*c*) samples and circulars carried by meter inspectors; (*d*) girls or youths engaged on a house-to-house canvass throughout the district, to whom a small commission is paid on actual sales—the full benefit accruing from the conversion of the sulphate to liquid ammonia would be derived.

As mentioned at the outset—and I wish to emphasize the point—our own experience as regards disposal of the product in any great quantity has been disappointing; but we have done comparatively little in the way of advertising, and, in fact, up to now have not experimented at all in the manner described under headings (*c*) and (*d*).

However, "desperate diseases require drastic remedies;" and if the price of sulphate continues to fall, this scheme, with attendant publicity methods in full, or some other scheme—such as the production and sale of concentrated ·880 ammonia in bulk—will merit careful consideration. The demand undoubtedly there is; and if it could be diverted to the local gas-works product, by some of the above publicity methods, the purchaser would receive better value, and the gas undertaking—and incidentally the gas consumer—would ultimately benefit to the extent of a substantial addition to revenue from the sale of ammonia products.

IS PUBLICITY NECESSARY AND PROFITABLE TO THE WELFARE OF THE GAS INDUSTRY?

By W. M. MASON, Manager of the British Commercial Gas Association.

It having been suggested by your President that I should give a short address on "Publicity," I have chosen for title a definitely challenging question which will, I trust, stimulate thought on what many in the industry consider to be a matter of first-class importance.

Publicity in the gas industry is naturally associated with the "B.C.G.A.," so what I have to say is interwoven with the policy and work of the Association. We do not wish to take things for granted; it is easy to get into ruts in business. A business man who was keen and progressive fifteen years ago might easily have allowed himself to drift, and to-day be a "back number." The need for reconsidering foundation principles is therefore wise and, especially when public money is being administered, necessary if confidence is to be maintained and increased.

I shall, first of all, try to deal with some points of criticism or differences of opinion on publicity which have been put to me from time to time, and have a strange way of being repeated from unexpected sources. "Many men, many minds," applies to our industry as to others. We do not all see through the same spectacles; but if it is possible to eliminate differences and divisions, to agree on essentials, and to unite for public good as well as for individual prosperity, surely that is a desirable ideal. Without the ability to co-operate and compromise—when no essential principle is at stake—we could hardly get along at all, at least where association on national lines is attempted.

To some of us who consider that publicity is one of the four essential pillars in successful business building (the others being capital, labour, and management) it may come as a shock to learn that some able and highly respected members of the industry still seriously consider that the need for advertising propaganda, either to defend or to boost a century-old public utility like coal gas, is neither necessary nor profitable.

As such an attitude of mind—which I know to be perfectly sincere—queries the wisdom of spending money on propaganda and incidentally suggests that the 92 p.ct. of the industry who contribute to the national pool for this purpose are misguided in so doing, the subject assumes growing importance. Those who do not see eye to eye with us have doubtless given the subject considerable thought, as they are quite as keen to run their undertakings on successful lines as we are. We therefore welcome every opportunity for stating the case for national propaganda and inviting the fullest discussion on it, in an endeavour to secure an entirely unbroken front, and to turn our few remaining critics into co-helpers.

SOUND PRINCIPLES.

We do not for a moment suggest that the "B.C.G.A." is a perfect organization with Executive and officials who never made or could make mistakes. [At least I can speak for the officials on that point.] Haloes are not part of our outfit. But it is surely reasonable to suggest that an organization must have been founded on sound principles and conducted on fair and efficient lines, which, launched only some sixteen years ago with a representation at that time of about 20 p.ct. of the industry, has so justified the faith of its founders that it has now secured an almost unanimous vote of confidence.

When we remember that the confidence is backed in the most effective way by producing the funds for carrying on the work, this claim at once assumes even greater significance. The big majority in the gas industry recognize that co-operative advertising conducted from a central source yields more valuable results than similar expenditure with little or no co-ordination.

SOME OBJECTIONS.

Some of our friends who contribute to the national pool, so that they may not be in the invidious position of receiving benefits from work paid for by their neighbours, are still influenced by the old proverb that "Good wine needs no bush." They overlook the very obvious fact that the proverb is belied continuously by sellers of Scotch and Irish whiskies, said to be the best (or worst according to one's personal point of view) in the world, as well as by the finest products in practically every sphere in modern business and industry.

It has frequently been said to me—"But surely everybody in the place knows about gas; we had our centenary last year." This quite natural illusion can speedily be dispelled by a little study of the meter ledgers, when the variations in consumption will reveal the fact that people living in the same street, in similar-sized houses, in probably similar positions in life, have remarkably dissimilar gas consumptions. The simple explanation is that one family evidently appreciate, understand, and avail themselves of the wonderful aid to domestic comfort and happiness that gas gives when properly used; while a neighbour, with a grouch perhaps, or, just as probably, through lack of experimental knowledge, does not appreciate or make the best use of the service.

This is one of the problems of advertising gas. The public think they know all about it, and that there is nothing new or useful to be learned about it. Publicity comes to open the eyes of the blind and show what potentialities for helpfulness this apparently old-fashioned, but really very much up-to-date, service possesses. Advertising is an effective form of education. The people who do not avail themselves of the remarkable labour-saving service that gas renders at very reasonable cost, if it is available, are the people who are, unfortunately, ignorant of its modern applications for domestic and trade purposes, or are prejudiced against it, or who cannot afford to pay for it. Ignorance and prejudice can only reasonably and permanently be overcome by knowledge; and honest propaganda is invaluable to that end. Our Executive Chairman recently emphasized this point in the "Bulletin" when he wrote:

> "The fact is that people to-day have so many opportunities of reading, hearing, and seeing so much about so many subjects of which they have either no knowledge or a mere useless smattering, that, unless they get the facts about any subject—say, any business—effectively presented to them frequently, they must not be expected to know anything whatever about it; they will be the prey of anyone who pretends to know, and takes steps to excite their suspicions and to play upon their ignorance; and, if their personal interests are touched, they will believe anything evil about it for want of the corrective knowledge."

If gas apparatus is out of order or adjustment, or the quality and pressure of the gas not what it ought to be, publicity will, of course, only accentuate and bring to light deficiencies on the district.

Advertising, it must be repeated again and again, is only one part of business development. It will never correct in some magical manner incompetence in other sections, or make up for lack of essential service; it will make inefficiency in any department more glaring. With supply and distribution right, or at any rate fairly efficient, it has been conclusively proved that good and persistent advertising will stimulate and develop the sale of gas just as it will stimulate the sale of any other commodity.

No contribution on this subject submitted to the gas industry could hope to be complete without including that fine old stand-by, semi-apologetic utterance that is sometimes intended to camouflage all sorts of sins of omission in other fields of service—viz., "The satisfied consumer is the finest form of advertisement." Of course, he, or rather she, is; and sensible propaganda can help "to soothe the savage breast" by forestalling increases in price, and taking the public into your confidence in matters of special difficulty.

CHEAP GAS.

Many in the industry, while supporting and advocating the need for propaganda, pin their faith mainly on low price. A salesman would be very foolish indeed to argue against low priced gas, and every effort to reduce prices demands serious attention. The question of price is indeed one of the strongest arguments for publicity, as any substantial increase in output should be reflected in the price at which the commodity can be sold. Usually the heaviest items in cost are capital and standing charges; and obviously any substantial increase in output means that these costs are spread over a wider field and should, therefore, be lightened.

This is fully realized, along with the fact that for certain trade and industrial uses, where very keen competition from low-grade fuels is frequently met with, a low price is essential if the business is to be secured or held.

With all this in view, however, the need for good service, even with low price, is essential. Cheap gas will not sell itself, as some seem to think. If a study of average gas sold per consumer is made, the rather astonishing fact will emerge that the price of gas seems to have very little to do with consumption, although local conditions and influences must, obviously, be taken into consideration. To mention only one instance from figures recently taken out. If the argument that price has seriously to do with output holds, why should one important undertaking, with a price of 10·6d. per therm, actually have practically the same average output per consumer as another undertaking of a similar residential character with an average price of 6d. per therm? The reason for this seeming anomaly is that, to my personal knowledge, the really essential factor—viz., the development of good all-round service, in which local advertising methods play a proper part—is recognized.

Our own personal habits of not buying the cheapest things in food, or attire, or houses, or, indeed, in most essentials, should be some guide to us. Our old-clothes friend had the best of the argument when, in reply to the protest of a cus-

tomer that the coat purchased the previous week was full of moths, said, "Vell, vot you expect for five bob—butterflies?" If we shout too much about "cheap gas," and neglect good service, the public, aided by our astute competitors, will inevitably add, "Yes, cheap and nasty." On the other hand, the wise appeal to the average buyer is on value, and there indeed we have the finest possible selling point either through the printed word or by personal salesmanship.

"Sell the idea back of the appliance" is a terse American way of putting another asset in good salesmanship. A gas fire or a gas cooker, or a gasholder even, is, of course (I speak before esteemed members of the B.G.I.), in itself a thing of beauty and a joy for ever when seen by an admiring gas manager. Other people, however, may not be quite so enamoured of its attractions. Better then to sell the fine idea behind the commonplace thing. The convenience, labour-lightening, cleanliness, perfect cooking, personal comfort, ease of control, and so on—these are the points to "get home" the argument. Get it into the municipal consciousness that the big holder stands for a great public utility—that it means instant and reliable service in the home and factory, and, incidentally, helps to solve the smoke problem of our cities. Associate the holder in the public mind with blue sky and clean air, educate the public conscience that the right thing is to "Use gas and let in the sunshine," and you have done a good thing not merely for the gas industry, but, what is better, for the public welfare. Honest propaganda can do, and is doing, all that. In the legitimate appeal to public spirit lies a lot of good business sense which has, and will continue to have, its practical reward.

Saturation.

It has been put seriously to me that advertising is unnecessary because saturation point has been reached in some districts. Lord Burnham recently made a terse reply on this point.

> "There was," he said, "one fallacy with which the Advertising Convention could, with good results, deal.
>
> "There was nothing more mischievous, or more petrifying, than the doctrine, so often laid down to excuse ineptitude and failure, of saturated markets. Not only had the markets not reached the point of saturation, but they had the ability and the energy to extend their boundaries to an extent that was hardly realized by those who did not take the trouble to work out for themselves how infinitely the wants of humanity might be multiplied."

The sound common sense in a speech by the President of the Board of Trade may also be cited:

> "Efficient salesmanship means studying your customers' desires, supplying them with what they want in the form they want it, at the time they want it, and in the place they want it. If you can do that, then no manufacturer and no salesman who has British goods to sell need be afraid that he will not hold his own, and more than hold his own, in meeting the desire that is already there in the different markets of the world. Salesmanship does not end there. It does not end in meeting the static and constant demand. The best salesmanship and advertising will anticipate the demand a little before it would otherwise come, *will create a new demand that is not there at all.* That is the most valuable form whether of advertising or salesmanship—and the two are married. In that way you add to the normal production of the world and raise the standard of living. You create new desires in men and women, and those desires have got to be met by work which adds to the work of the world, adds to the purchasing power of the world, and, incidentally, adds to the peace of the world."

A brief study of the output figures for the gas industry during the last twenty years would surely convince the most pessimistic that saturation is a bogey that need never seriously worry the energetic and intelligent gas salesman.

Enormous Increases.

The following figures are taken from "The Gas World Year Book," that excellent and valuable compilation of national gas statistics:

Year.	Annual Make in Millions.	Increase	Number of Consumers.	Increase.	Cookers and Grillers.	Increase.
		P.Ct.		P.Ct.		P.Ct.
1907	181	..	5,535,799	..	1,994,427	..
1912	205	13·0	6,774,357	22·3	2,921,299	46·5
1917	232	13·3	7,862,749	16·0	4,468,979	52·9
1922	268	15·7	8,103,631	3·0	4,900,072	9·6
1927	304	13·2	8,959,702	10·5	5,788,696	18·1
Increase of 1927 over 1907 . .	..	68·1	..	61·8	..	190·2

That these enormous increases in the use of gas—successive increases on the top of increases—should have been attained in face of most active and growing competition, makes them even more significant.

Could anyone have dreamt that the tremendous gas load developed during the hectic war time could have been absorbed in other directions, as the national figures prove? Remember the almost immediate shutting-down of munition, engineering, shipbuilding, and other abnormal output, followed by the inevitable, but none the less deplorable, slump in trade. The simple facts embodied in the figures I have just indicated are really astounding in their magnitude. To-day the gas industry stands on a pinnacle as a public utility service.

If this continually growing demand for gas is not a direct result of the new spirit in the industry, as exemplified in good national and local advertising, greatly improved showrooms, and better service to the consumer, perhaps someone will kindly tell us where it came from. Such enormous increases on top of a century of public service certainly do not fall like dew from heaven. *A reasonable view is that they are the result of tremendous and sustained activity in the profitable and allied art of salesmanship and publicity.*

The President of the National Gas Council said only this month, in connection with the Road Tar Association, when speaking of the effects of the widespread publicity given to various road making materials:

> "Widespread publicity has been given to the various applications of those materials. I do not criticize this publicity. What I wish to point out is that *the absence of any sustained publicity campaign in regard to tar* has led a large section of the public into the erroneous belief that, with the changed circumstances tar has ceased to be able to fill the role which it has hitherto filled, and that newer and more suitable materials have arrived to take its place."

Is it not fair and reasonable to question what the possible state of gas output might have been to-day if, through neglected propaganda—truthful and sincere, with, behind it, a real and honest endeavour to give the public a square deal—the industry had shut its eyes to its duty to the consumer as well as to its own opportunities? Truly it is the wise man who says, in the Old Book:

> "There is that scattereth and yet increaseth, and there is that with-holdeth more than is meet and it tendeth to poverty."

Local Publicity.

In considering objections to national co-operative publicity, the most important is probably summed up in the statement: "Oh! we believe in advertising, but we think we can spend the money better locally." The obvious answer is that both national and local publicity are essential. The one supplements the other and makes both more valuable.

The regular insertion of effective advertisements in local newspapers has, at least, three important results:

(1) It informs and interests and influences consumers.
(2) It is a proof that the gas department really tries to look after its business, and is setting up an ideal of service.
(3) If properly handled, it secures the goodwill of local editors.

There is no ulterior suggestion behind this last point. Newspaper people are like the rest of us. If treated in a fair, reasonable, and businesslike way, they will reciprocate. As a general rule they treat their customers as we try to treat ours. They wish reliable and "newsy" information, and, if the matter is worth noticing, they will give it space. If proper relations with the local Press are established, when nasty folk come along and want to make trouble, editors will ring you up on the 'phone and ask for your side of the story. The proper cultivation of the Press is like the proper cultivation of any other business friendship, and is based on goodwill, fair dealing, and tact. If you want good reports of your speeches, or visits, or what not (unless you happen to be a Cabinet Minister), get a summary prepared to hand to the reporters.

Local advertising should include clean and efficiently handled showrooms in a prominent part or parts of the district, the regular distribution of educational literature giving facts relating to local service, as well as true and reliable information on the many branches of gas service. In the preparation of literature, the supply of blocks and "copy," showroom window displays, and the organization and equipment of showrooms and stores, the Association acts as consultant and co-operative provider. It has helped to establish a "big brother" movement whereby some of the large and finely equipped undertakings help smaller isolated members.

The organization of District Conferences and Salesmen's Circles by the "B.C.G.A." is also a direct stimulus and aid to local and district publicity, while help given regarding local exhibitions is in the same category.

The Primary Purpose.

But what of the primary need for national propaganda? The first and main purpose of the "B.C.G.A." is to act as the central organization from which advertisements are issued to all sorts of newspapers and periodicals of widespread circulation, popular and illustrated journals, technical and trade publications, and so on. With the money available it is possible to undertake schemes such as are now in regular operation. The pity of it is that we cannot go into every important paper at much more frequent intervals. Many attractive schemes have to be turned down through lack of funds.

In the brief summary of the work undertaken by the National Bodies, which has just been issued with the appeal for increased subscriptions over the signatures of the three Presidents, the following paragraphs may be cited:

> "The British Commercial Gas Association was formed for the purpose of developing the commercial side of the gas industry.

"Chief among the Association's activities are:

CO-OPERATIVE PUBLICITY.

"Advertising campaigns are regularly and consistently conducted in selected media of wide national and district influence and circulation, with the object of educating all classes of the community in the advantages of the use of gas for light, heat, and power, and creating a general atmosphere favourable to gas.

"Educational propaganda is an important feature of the Association's publicity campaigns, and special steps are taken to reach the medical, scientific, architectural, and teaching professions, all of whom help to mould public opinion.

"The Association's Editorial Department is the link between the gas industry and the Press of the country. Special attention is given to the maintenance of friendly relations with the Press, and careful watch is kept upon statements and articles prejudicial to the interests of gas."

SOME COSTS.

Advertising costs money. To take one page in "Punch" once a week for one year would cost practically £13,000; while the front page in "The Daily Mail" for a year would cost over £70,000. These are big figures, but remember the enormous number of people who could read your message by these mediums. Let me hasten sadly to reassure you that we do not take "Daily Mail" front pages very often. In considering costs it is wise to think in percentages rather than in round figures, which are often misleading. American public utilities spend at least 2 p.ct. of their turnover in advertising. The big London stores allocate from 2 p.ct. to 10 p.ct. of turnover to advertising; while the gas industry, with a capital involved of over £160,000,000, and faced with growing competition, is content to spend about one-tenth of 1 p.ct. in national publicity.

In view of the publicity and propaganda undertaken on behalf of individual business firms, many of whom spend more annually with one newspaper than we spend altogether, would any gas man, I wonder, object to seeing gas and its uses advertised every week in every important publication in the country?

The pity of it is that we cannot do the impossible; we can only cut our kilt according to our cloth, and, alas, it is already "bobbed" to the verge of indecency. To indicate how far we might profitably use this most valuable investment for the furtherance of our business, I may state that a responsible representative of an American Gas Company recently told me that his Company were spending practically as much on publicity in their own district as we were spending on behalf of the whole industry.

The "B.C.G.A." is a channel or clearing house, by means of which individual contributions of even the largest subscribers are made more effective and are returned to them in the form of national advertisements and service—much of it behind the scenes and not to be made public—which is acknowledged by many of the keenest minds in the industry to have proved beneficial.

While large subscribers to the national funds are satisfied that their publicity investments are sound, the smaller units can remember that, for their contributions, even if no "blanket" newspaper covers their district, many of the weekly and monthly periodicals circulate and influence local public opinion, and that for their—in many instances—modest annual subscription they are participating in an extensive and widely influential advertising scheme.

The allocations for various district publicity is in direct relation to the total amount subscribed by each district, and is, therefore, on a fair and equitable basis. An industry lives by its individual members. By extensively advertising itself as an industry, or undertaking wide propaganda concerning some definite branch or section, the public as a whole is influenced, and the individual members benefit by the prevalent subtle inclination of thought induced by persistent, wisely-controlled articles in the Press dealing with the subject selected. Too great an economy in efforts such as these is a mistake, simply because a "thin" campaign is a waste of both time and money. To be impressive to any reasonable proportion of the population any prolonged effort at publicity must be carried through properly, with freedom and ease.

In a leading note in one of our esteemed technical papers only this month the following paragraph appeared:

"Publicity is no less essential than protection. Indeed, publicity is a form of protection, a shield against harmful shafts from without, and a safeguard from lassitude either in the gas supplier or the gas consumer. In this sphere the British Commercial Gas Association has established a high position as a truthful exponent of what gas has done, is doing, and will do, if given freedom from restrictions that would otherwise prevent its full development."

A VARIED STORY.

In thinking of propaganda our minds turn to the wonderful tale of varied and efficient gas service we have to tell. For public consumption, if we can wrap our facts and figures in a love story they need be no less truthful and will be more palatable. The need for understanding the woman's point of view, so far as that is possible of understanding, is another essential qualification in effective propaganda.

In view of growing competition the necessity for installing efficient appliances is imperative. The flimsy and inefficient gas appliance has a lot to answer for in the tale of dissatisfaction. The concluding paragraph in a report on important comparative tests recently carried out with various forms of cooking applications needs the serious attention of the industry:

"It is more necessary than ever for gas undertakings to supply their consumers with cookers of the most efficient design and construction, and to maintain them in good working order; to give consumers advice as to their economic use; and to supply gas of constant quality and adequate pressure at a reasonable price."

GASEOUS FUEL.

In trade and industry gas service has enormous possibilities for development. At the present time gaseous fuel has been applied to many processes in over 3000 trades. Publicity appeals, based on just claims of gas as regards labour and space saving, ease of control, regularity of temperatures, and increased output, are sound; but the need for backing this with expert personal knowledge is imperative. Big business in gaseous fuel development has come and is being held and developed largely by means of experienced, qualified industrial salesmen, who are capable of giving practical advice and of carrying out experimental work in installing and adjusting appliances to suit particular problems. As a rule it is found that practically every problem has to be dealt with individually and experimentally. Only by patient "nursing" can big business be secured—as for instance, the use of gas for biscuit baking in Glasgow, where the total consumption for this purpose is approximately 500 million c.ft. per annum. An indication of the possibilities of applying gaseous fuel to industry may be gathered from the fact that nearly one-third of the output of the Birmingham Gas Department, or approximately 4000 million c.ft. of gas, is used for industrial heating purposes.

The "B.C.G.A." issues monthly a publication entitled "A Thousand-and-One Uses for Gas," dealing with various installations of great importance. Good business has resulted from the distribution of this periodical; but the best and biggest business will be secured by the industrial salesman personally "nursing" local possibilities. The Association has given, and is always ready to secure, helpful advice on any special proposition or process on which special information is required.

LOCAL TRADE.

It is interesting, in this connection, to learn, from information I have received locally, that gas is supplied in Cork for quite a number of trade processes, including the following:

Sugar boiling in sweet factories.
Jam boiling in confectioneries.
Linotype machines, &c., for printers.
Branding bacon in pig killing and curing factories.
Vulcanizing in motor works.
Brazing, &c., in radiator factories.
Tinmen's stoves for soldering.
Glue boiling, &c., in cabinet making factories.
Various processes in boot factories.
Various processes in clothing factories.
Various processes in dyers and cleaners works.
Various processes in dentistry.
Tailors and dressmakers, &c.
Cooking in restaurants and hotels.
Tempering tools in machine works.
Boiling meat for cooked meat vendors.
Frying fish, &c.
At extra high pressure in laundries.

Gas is the motive power for generating electricity in many cinemas, and for working various machines for:

Printers.
Builders.
Butter factories.
Clothing factories.
Engineering workshops.
Stonecutters, &c., &c.

We have at the Association headquarters detailed and interesting facts available for the use of members regarding practically all these trade processes.

Now, I fear I have taken more than my share of your time and patience. My excuse is the fascination of a fine subject, about which the more one thinks the more enthusiastic must be his advocacy. I hope the logical conclusion we have all reached is that the greater advertising of gas—both nationally and locally—is increasingly necessary, and will prove still more profitable.

I cannot close on a better note than by quoting part of a recent speech by our esteemed Executive Chairman, Mr. Goodenough:

"When one remembers that the 'B.C.G.A.' has only been in being for about sixteen years, those of us who assisted at its birth and fostered its growth may well feel encouraged by the extent of its present achievements; but we believe that the achievements of the past are as nothing to the possible achievements of the future, if the spirit of co-operation, faith, and enterprise, which animates its members, burns as brightly in the years to come as it is burning now; and I for one have no shadow of doubt but that the spirit will burn not with diminishing, but with increasing, intensity as year follows year."

BETTER FORMS OF RATES FOR GAS.

A DISCUSSION OF RATE-MAKING BASED ON ALLOCATED COSTS.

Approved and Adopted by the Executive Board of the American Gas Association.

(*Continued from p. 327.*)

IN WHAT WAYS MAY RATES EMBODYING ALLOCATED COSTS BE PRACTICABLY INTRODUCED?

Progress towards better forms of rates for gas may be secured along one or more of several channels. Rates based on soundly ascertained and allocated costs may be made applicable to all the customers of a gas company. Rates of this character may sometimes be inaugurated, as a practical matter, by offering an optional or alternative rate of sound formulation, without disturbing the existing rate structure—such optional rate to be available to all existing or new customers whose extent or conditions of use of gas enable them to go on the optional rate, if they desire it. Allocated costs may, and should, also be made the basis of special rates for certain classes of business, or a rate to be applied to new territory about to be served by a company.

The formulation and introduction of optional rates need to be watched and studied with great care—especially when an optional rate is to be made available to domestic customers. An optional rate may be so set-up as not to require all customers to pay their own way, but rather to permit each customer to select the schedule or option under which he would pay the least.

For example, the X company has a straight meter rate of $1.50 per 1000 c.ft. It is considering the filing of an optional schedule of a fixed charge of $1.50 per month *plus* $1.00 per 1000 c.ft. for the gas used. This rate would be available to all customers, but naturally will be attractive only to those customers using, or intending to use, more than 3000 c.ft. of gas per month.

If, instead, a change were made to a rate applicable to all customers, a fixed charge of 80 cents per month, *plus* $1.00 per 1000 c.ft. would yield exactly the same revenue on present sales as would be received under the optional method. Or, if it is desired to use a more prevalent form, the following set-up would also yield the same revenue:

For the first 200 c.ft. or less of gas used each month. . .	$1.00
For all additional gas, per 1000 c.ft.	1.00

Either of these forms of rate would make dollar gas available to all customers, would lower the bills of all customers using more than 1600 c.ft. of gas per month, and would give the company the same revenue on present sales as the opional plan.

On the other hand, circumstances may arise where to continue a new or existing class of customers on the present rates would put upon them an undue burden, disproportionate to the cost of service. The conditions of their use of gas may be such as to make the existing rate structure unsuitable for them or unjust to them. In such circumstances, an optional and alternative form of rate may equitably be offered to wholesale or special classes of business, even though those rates are offered as optional schedules, available to all applicants who conform to the specified conditions of use. Under such an optional schedule this class of customer would pay less than they would have been compelled to pay under the existing general schedule, but might, nevertheless, pay all that they equitably should in view of the cost and conditions of serving them. Even in such cases, if the general service schedule for the remaining customers is of a straight meter type, the tendency is for the special optional schedule to become higher than would be necessary if the entire rate structure were equitably based on allocated costs.

An optional rate may also be employed to advantage, at times, for experimentation to ascertain the most desirable forms of rates for a particular community. Where a company is willing to sacrifice some of its earnings for a year or so, an optional rate may be used for a trial period, with the understanding that at the end of the period either the new or the old rate will be abolished.

TO WHAT EXTENT HAVE THE PRINCIPLES OF ALLOCATED COSTS BEEN ADOPTED IN RATE-MAKING?

As early as 1891, we find mention of the service charge made by Walton Clark as a means of doing justice to the customers. He claimed that if a certain fixed sum to cover meter expense and office expense were charged to each customer, the remaining expense, when divided in proportion to the gas sold, would result in a reduced rate per 100 c.ft. to all customers and a lower average rate to encourage business.

The service charge existed to a very slight extent in some of the older schedules in the form of a meter rent; but this was merely a slight differential to favour those customers who purchase their own meters. Advocacy of the service charge did not mean its adoption; for we find only one service charge in use before 1913, and that was a charge of only 30 cents a month. One or two companies attempted to improve existing conditions without introducing service or other distinct charges, by requiring a minimum payment per month for those cases where the consumption figured at the rate per 1000 c.ft. did not equal the minimum. In 1910, few gas rate schedules which included the minimum charge were in effect; but the plan has received extensive application and approval in subsequent years, after overcoming some early opposition, until, in the country as a whole, about 90 p.ct. of the schedules for manufactured gas appear to include a minimum bill or a substantial equivalent.

On the whole, the introduction of the principle that every customer should pay at least a minimum sum per month, in the event that he did not use sufficient gas to make his bill reach that minimum, has been a step forward, and has helped to a better understanding of rate-making. It has oftentimes been urged and advocated by those who opposed the service charge or the three-part rate. As a matter of rate-making based on allocation of costs, a minimum charge which merges into the charge for the actual consumption when the minimum is thus exceeded is not as sound as a service charge or a three-part rate, under which the actual costs of the service control determine the payment therefor. As a means of making the casual, intermittent user of gas pay his own way, instead of permitting him to load a part of his costs on the householders and industrial consumers, the minimum bill does not go far in revenue-producing effects. A minimum bill of $1.00 a month usually yields no more revenue than a service charge of 10 cents per month.

For instance, consider a company with a rate of $1.20 per 1000 c.ft. and a minimum bill of $1.00 a month. At that rate, all customers using 800 c.ft. or less will pay the minimum. Assume that 25 p.ct. of the customers are in this class, and that the average consumption of the group is 500 c.ft.—500 c.ft. at $1.20 per 1000 c.ft. is 60 cents, which deducted from the dollar minimum gives an average service charge collection of 40 cents a month. As the group includes only 25 p.ct. of the customers, the 40 cents dwindles to 10 cents when applied to 100 p.ct. of the customers.

The first published mention of the three-part rate, as such, was in 1900, in a paper by Henry L. Doherty, who advocated the use of the three charges in selling electricity. A year or two later the use of the rate form was recommended to the gas industry in a paper by Frank W. Fraueauff. The first three-part rate (installed about 1905) was not put in as a universal rate, but as an optional rate wherewith the company could get some additional business not obtainable on a straight meter basis. No such rates appeared in gas company schedules except as optional or special rates until 1920. However, in 1917 a rate was put into effect in Chicago which contained a charge for the first 350 c.ft. or less; this charge being varied according to the meter size, so that the rate contained the three-part principles. For industrial service, the first rate embodying allocated cost principles, and with a low commodity charge, appears to be that put into effect in Baltimore, in 1915.

The world war aroused many gas companies to a realization of their difficulties. The increased cost of supplies and labour necessitated increased rates; and, strange as it seemed to many gas men, increases in uniform rates did not, as a rule, result in the estimated new revenue, for sales dropped-off proportionately. This necessitated new increases; and in one case as many as seven successive increases in rates were found necessary. This failure of the straight meter rate was ascribed by some analysts to the fact that, consciously or unconsciously, the American family head used a budget on the household expenditures and fixed an approximate sum to be spent for gas, regardless of the rate per 1000 c.ft. When the price was increased, the family use of gas was curtailed to bring the expenditures to the customary figure.

This budget principle undoubtedly had something to do with the drop in sales; but another reason which has been offered was the failure of the meter rate to meet competition. On a straight meter rate the company received a very high rate of net earnings from the customer using fairly large quantities of gas for domestic purposes, even when losing money on the business as a whole. When the gas rate was raised, it was this customer, already paying more than his share, who was asked to pay the bulk of the necessary increase. The result was that the charges for gas on such a customer were raised to a point where the convenience of gas was offset by the comparative cheapness of some other fuel, and the customer stopped using gas or employed the other fuel for his principal requirements, depending only on gas for quick or emergency service. Many companies felt forced to turn to the service charge for additional revenue; and while that helped, it was not a popular move, for the charge per month was put in as an emergency measure, as an addition to the existing gas bill

which the customer, considering that he was receiving nothing additional, resented.

The use of rates based on the principles of allocated cost has increased, until to-day we have, according to Rate List No. 5, Jan. 1, 1927, the following:

1.—Rates for All Domestic Customers (1927).

—	Number of Schedules.	Number of States.
(*a*) Fixed charge expressed as such:		
$1.00 or more per month	13	6
$ .50 to $1.00	66	18
Less than $ .50	26	13
Total above	105	27
(*b*) Fixed cost included in the charge for the first few hundred c.ft.:		
$1.00 or more over and above the commodity charge of the few hundred feet	8	5
$ .50 to $1.00	79	25
Less than $ .50	115	26
Total	202	35
Total available as sole domestic rate	307	40

2.—Special Rates for Special Classes (1927).

—	Number of Schedules.	Number of States.
(*a*) With fixed charges or with fixed cost included in first few hundred	36	11
(*b*) With demand charges	114	16
(*c*) With three charges	59	20
Total	209	28
Total rates based on fixed charge principles	516	43

—	Number of Schedules.	Number of States.
For Comparative Figures, Rate List No. 4, Jan. 1, 1926, shows:		
1—(*a*) Fixed charge expressed as such	104	22
1—(*b*) Fixed cost included	142	14 additional
Total as sole rate	246	36
2—(*a*, *b*) Special demand rates	35	3 additional
2—(*c*) Rates with three charges	16	..
Total	297	39

If the natural gas business is included, the total number of rates based on fixed charge principles, as at Jan. 1, 1927, becomes 668 in 44 States. Twenty-three State Commissions have upheld the service charge in published decisions. Three-part rates with demand-limiting meters have been in effect in Ottawa, Kansas, for seven years in connection with the supply of natural gas. They have also been in effect in a number of other natural gas communities for shorter periods. Rates embodying three-part principles and applicable to all customers have been put into effect by several manufactured gas companies—the Montgomery (Alabama) illustration being conspicuous. The Montgomery rate is a two-part rate with a fixed charge which varies with the demand.

The most popular type of improved rate would seem thus far to be that in which at least a part of the fixed cost is included in the charge for the first few hundred c.ft. or less used each month.

WHAT HAVE BEEN THE RESULTS OBTAINED BY INSTALLING RATES EMBODYING COST ALLOCATION PRINCIPLES?

In the natural gas business, the results are expressed in the decision of the Kansas Commission as to the gas rates of the Ottawa Gas and Electric Company. In regard to the manufactured gas companies, the results are expressed in the decision of the Alabama Commission in the Montgomery case, and as shown in the following tables:

Twelve Months ending March 31.

—	Results Under Old Rate. (See note.)	Results Under $2.00 Straight Meter Rate.		Results Under Two-Part Rate.			
	1921.	1922.	1923.	1924.	1925.	1926.	1927.
Number of customers (average)	3144	2995	2810	2863	2927	3,011	3,273
Monthly sales in 1000 c.ft.	9740	8340	7492	8318	9604	10,642	12,068
Monthly revenue in dollars	$14,992	$16,786	$15,094	$14,104	$15,638	$16,637	$18,043
Sales per customer, c.ft.	3100	2790	2670	2900	3280	3,530	3,687
Monthly bill per customer	$4.77	$5.60	$5.26	$4.92	$5.32	$5.52	$5.52
Average price per 1000 c.ft.	1.54	2.00	2.00	1.69	1.63	1.56	1.50

NOTE.—The old rate of $1.40 per 1000 c ft. was effective during nine months of the period covered by this column, after which the $2.00 per 1000 c.ft. rate was introduced, the year's figures therefore including three months of operation under the $2.00 rate.

Expressed in Per Cent. of 1923 Figures.

—	Old Rate.	$2.00 per 1000 C.Ft.		Two-Part Rate.			
		1st Year.	2nd Year.	1st Year.	2nd Year.	3rd Year.	4th Year.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.
Number of customers (average)	112	107	100	102	104	107	116
Sales in 1000 c.ft.	131	112	100	111	128	142	161
Revenue in dollars	99	111	100	93	104	110	120
Per customer:							
Sales in c.ft.	117	106	100	109	123	132	138
Monthly bill	91	106	100	93	101	105	105
Average price per 1000 c.ft.	77	100	100	84	81	77	75

For more than 90 p.ct. of the customers, the Montgomery rate is in practical effect $2.00 per month, *plus* a commodity charge of $1.00 per 1000 c.ft.

It will be noted from the above that the number of customers, sales, and revenue were decreasing under the straight meter rate of $2.00 per 1000 c.ft. It will also be noted that, while the adoption of the two-part rate involved a rate reduction and a temporary decrease in revenue, this revenue has been more than made up by increased sales under the changed form of rate.

The results of changes in rate form in Tonawanda (New York) are shown by the following: About March 21, 1921, in

Tonawanda, New York.

—	April to September (inclusive)—Six Months.					
	1920.	1921.	1922.	1923.	1924.	1925.
Retail rate per 1000 c.ft.	$1.00	$2.25	$1.75	Combination	‡	‡
Total number of customers	3,773	3,628	3,583	3,631	4,083	4,387
Total sales in millions	123	41	57	71	86	104·6
Revenue in dollars	$88,132	$92,528	$85,921	$87,759	$99,601	$114,954
Per month per customer—						
Sales in c.ft.	5,150	1,890	2,670	3,260	3,570	3,980
Revenue in dollars	$3.90	$4.25	$4.00	$4.03	$4.11	$4.37
Average price per 1000 c.ft.	$ .72	$2.25	$1.51	$1.23	$1.15	$1.10
Variation in price per 1000 c.ft.	..	+212 p.ct.*	− 33 p.ct.*	− 19 p.ct.*	− 24 p.ct.†	− 27 p.ct.†
Variation in total revenue	..	+ 5 p.ct.*	− 7 p.ct.*	+ 2 p.ct.*	+ 16 p.ct.†	+ 34 p.ct.†
Variation in revenue per customer	..	+ 9 p.ct.*	− 6 p.ct.*	+ 1 p.ct.*	+ 3 p.ct.†	+ 9 p.ct.†
Domestic sales in millions	53·4	37·0	42·3	52·1	63·3	72·8
Domestic revenue	$53,582	$82,983	$73,394	$72,923	$86,133	$97,492
Per month per domestic customer—						
Sales in c.ft.	2,390	1,720	1,980	2,420	2,620	2,770
Revenue in dollars	$2.40	$3.85	$3.45	$3.39	$3.56	$3.71
Average price per 1000 c.ft.	$1.00	$2.26	$1.74	$1.40	$1.36	$1.34
Variation in domestic price per 1000 c.ft.	..	+126 p.ct.*	− 23 p.ct.*	− 20 p.ct.*	− 22 p.ct.†	− 23 p.ct.†
Variation in total domestic revenue	..	+ 55 p.ct.*	− 11 p.ct.*	− 1 p.ct.*	+ 19 p.ct.†	+ 33 p.ct.†
Variation in domestic revenue per customer	..	+ 60 p.ct.*	− 11 p.ct.*	− 1 p.ct.*	+ 3 p.ct.†	+ 8 p.ct.†

* As compared to previous year. † Compared to 1922. ‡ $1.10 for the first 100 c.ft., *plus* 10 cents per 100 c.ft. for the balance.

connection with the discontinuation of its supply of coke oven gas the Gas Company in Tonawanda raised its retail rate from $1.00 to $2.25 per 1000 c.ft. The high rate was in effect for about seven months, being then reduced to $1.75 per 1000 c.ft. A year later, in October, 1922, it was recommended that the rate be cut to $1.50 per 1000 c.ft.; but a combination rate equivalent to $1.50 (based on sales at that time) was used instead. This rate was $1.10 for the first 100 c.ft. *plus* 10 cents a hundred for additional gas, and is still in effect (June, 1927).

The following data shows a comparison of the four rates, both as to the effect on the total gas used and as to the effect on individual customers. The same six months period was used for each rate.

Effect of Rate Changes on a Group of 44 Customers comprising all the Customers on a "Working Man's Street."

Year.	Average Rate per 1000 C.Ft.	Per Customer per Month.		Increase over Previous Year.		
		Sales in C.Ft.	Revenue in Dollars.	Rate.	Sales.	Revenue.
				P.Ct.	P.Ct.	P.Ct.
Straight meter rates—						
1920	1·00	3010	3.01	..	..	..
1921	2·25	1950	4.39	+ 125	− 35	+ 46
1922	1·75	2380	4.18	− 22	− 22	− 5
Combination rate—				Increase over 1922.		
1923	1·40	2730	3.73	− 20	+ 15	− 11
1924	1·34	2920	3 92	− 23	+ 23	− 6
1925	1·30	3300	4.30	− 26	+ 39	+ 3

The figures cover only six months of each year (April to September inclusive); the $2.25 rate having remained in effect only that long. This short period also accounts for the high revenue per customer under the $2.25 rate, for many customers were naturally slow in replacing gas ranges, &c., with coal burning equipment. The sales were rapidly falling off when the rate was cut to $1.75 per 1000 c.ft.

The manager of a company charging $1.50 for the first 200 c.ft of gas makes the following statement: In the thirteen months that I have been here I have heard only one customer raise any question about the fairness of this type of rate. It has been my experience that it is comparatively easy to justify this type of rate with the public, if it is gone at in the right manner and the public is thoroughly informed of the necessity and fairness of this type of rate. I, of course, need not comment to you on the advantages to the company of this rate form.

The manager of another company having a charge of $1.75 for the first 200 c.ft. or less of gas used each month states that it is so long since he has had an argument with a customer over the necessity of such a charge that he has forgotten how to explain it properly.

WHAT HAS BEEN THE EFFECT OF THE FIXED CHARGE PRINCIPLE WHEN APPLIED TO ELECTRIC RATES FOR RESIDENCE SERVICE?

The manager of an electric company who for several years considered it impossible to instal a universal fixed charge on all residence customers writes as follows:

Referring to your letter regarding the effect on the public of the installing of our residential demand rate, which was a fixed charge of $1.00 per month for a 10-ampere, 2-wire meter; 5c. per KW.-hour for the first 40 KW.-hours used and 3c. per KW.-hour thereafter, with an increase of 60c. per month for each 5-ampere additional capacity of meter.

We put this rate into effect on Jan. 1, 1926, have been on it almost a year, and I will say that we have had practically no adverse comments. There was not a single meter removed; and out of our 9000 customers I do not think 50 came into the office and made a kick, and all of these were satisfied when they left. I believe that 90 p.ct. of the sentiment is in favour of the new rate over the old rate; and if it were put to a vote it probably would come out that way.

I did have at the beginning some feeling that there would be opposition; but this was imaginary, and as a matter of fact we have not had as much complaint as we ordinarily do in any change of rate. Of course, some people are going to kick anyway, regardless of what change is made; but I do not believe that this will create any larger kick, if as large, as if a change of some other kind would be made. I am thoroughly solid on the rate as we have it, as it gives us a better all-round year revenue than we had before, and offers an additional inducement for the installation of current consuming devices.

The manager of another electric company which installed a $1.00 per month universal fixed charge states:

Our public is becoming more or less educated to the principles involved in the fixed charge rate; and we are having less and less trouble in convincing them of the desirability of such a form of rate, from the standpoint of both the Company and the customer. During our last negotiations for a new rate ordinance covering the ensuing five year period, the matter of the fixed charge did not seem to be such an important factor in our negotiations. Our experience shows us that the fixed charge form of rate allows us an opportunity to develop our business to a much greater extent than any other form of rate. As an example, in 1922 we had an average use of 326 KW.-hours per domestic customer per year; and by the end of 1925 this use had been built up to about 400 KW.-hours per domestic customer per year; and by the end of 1926, from present indications, it will be slightly in excess of 425 KW.-hours.

(To be concluded.)

GAS-WORKS RECONSTRUCTION AT YEOVIL.

New Glover-West Verticals and Other Plant.

Extensive new plant and machinery at the Yeovil Corporation Gas-Works were formally inaugurated on Aug. 11. The reconstruction work puts on the most up-to-date basis works built by a private Company in 1833; and an interesting feature of the opening ceremony was the presence of three of the old Directors—Dr. W. A. Hunt, Mr. John Vincent, and Mr. Ebenezar Pittard. The ceremony was attended by the Mayor and Mayoress (Alderman and Mrs. P. W. Petter), members of the Town Council, including the Chairman of the Gas Committee (Alderman H. E. Higdon) and Mr. F. Clothier (Vice-Chairman), the Gas Manager (Mr. W. J. Imbrie), and a large number of visitors. Before the formal inauguration, the company were entertained at tea by the Mayor.

At the conclusion of the tea,

NEED FOR RECONSTRUCTION.

The MAYOR said that they were met to inaugurate a new era in the history of the Yeovil Gas-Works. It would seem that their predecessors on the Council felt they had paid such a large sum to acquire the works that they determined to use them to the bitter end, for they left them unimproved by any new plant for a long period. Very little was spent on plant or works before 1921. The Gas Committee in that year, however, set about to effect an improvement. The first step was the installation of a water gas plant, but for which they would have been in serious difficulty when on two or three occasions they had had to carry on with a limited supply of coal. Last year for a period it carried three-quarters of the burden of the gas supply of the town. The Mayor described how it was decided to instal the present system of vertical retorts; and provision had been made for duplicating them. They were now able to produce a supply of gas amply sufficient for all their needs.

PRICE OF GAS.

Alluding to the price of gas, the Mayor remarked that while the new work was being carried out they were able consistently to reduce the price of gas. The price in 1921, considerably higher than in pre-war days, was 6s. per 1000 c.ft. The gradual reduction that had ensued was shown by the following figures: 1922, 5s. 9d.; 1923, 5s.; 1924, 4s. 9d.; 1925, 4s. 5d.; 1926, 4s. 5d.; 1927, 4s. They had hopes that, when the full benefit of the new plant was felt, they would be able to make a still further reduction.

A TRIBUTE TO THE MANAGER.

Alderman H. HIGDON, proposing "The Contractors," said the new plant had exceeded all that had been promised. The work was commenced in August, 1925; and when the general strike came in the following year it was carried on under tremendous difficulties. The plant was "lighted-up" in August, 1926, and the making of gas commenced in October. The holding-up of materials had involved great cost and hardship, but this had been entirely borne by the contractors. Alderman Higdon referred to the presence of Mr. William Tucker, who had been for fifty years in the employ of the Gas Company, and he remarked that another employee, Mr. Harry Hann, had completed over 41 years' service. Concluding, he paid a tribute to the capabilities of the Manager, Mr. W. J. Imbrie.

The MAYOR, associating himself with this tribute, remarked that the whole of the new work had been carried out under the direction of Mr. Imbrie.

Mr. RONALD GLOVER, of West's Gas Improvement Company, replying, spoke of the pleasant relations there had been between Mr. Imbrie, members of his staff, and himself. Mr. Imbrie had his ideas very clearly in his mind, and they had been able to join with him in producing a scheme which was in every way satisfactory.

The MAYOR remarked that they were able to produce 111 million c.ft. of gas in 1921, and could produce 145 million c.ft. to-day.

Dr. HUNT then gave an interesting outline of the formation and working of the original Company; and the early days were also referred to by Mr. VINCENT and Mr. PITTARD.

PRESENTATIONS.

A pleasing incident that followed was the presentation by Mr. F. CLOTHIER of duplicate silver rose bowls to the Mayoress and Miss C. Higdon (daughter of the Chairman of the Gas Committee), to mark the interesting occasion.

The MAYORESS and Miss HIGDON suitably replied.

Mr. J. TAYLOR, of Weston-super-Mare, voicing the pleasure of the visiting engineers, said the provision of the new works for a town of the size of Yeovil was thoroughly justified.

The Plant Inaugurated.

The new plant was afterwards formally opened by Miss Higdon tipping a decorated truck of coal into the breaker by means of the hydraulic ram, the wheel of which she turned. An inspection of the new works followed.

NOTES ON THE WORKS.

The original Yeovil Gas-Works, built by the Yeovil Gas Light and Coke Company in 1833, were acquired by the Yeovil Corporation in 1898 at an agreed price of £88,360. In 1922 the modernization and improvement of the works was put in hand. It was decided to instal Glover-West continuous vertical retorts of a daily capacity of 750,000 c.ft., washing and scrubbing plant, workshops, and to convert the original retort house into a coal store, together with various other constructional alterations to existing buildings.

COMPREHENSIVE RECONSTRUCTION.

At the same time, two Waller exhausters of a daily capacity of 960,000 c.ft. were installed, with a De Laval compressor, capable of passing 75,000 c.ft. per hour at 80 lbs. per sq. in. pressure and 2200 R.P.M. Two water-tube condensers and a Holmes rotary washer and tar extractor were also put into operation. Three of the five purifiers were replaced by two large dry-sealed boxes, and the two remaining boxes were converted to dry seal; connections being so arranged that the whole battery can be operated on the reverse flow principle. In 1922, also, two Lancashire boilers were installed, and during the following year the construction of a Humphreys & Glasgow carburetted water gas plant of a daily capacity of 380,000 c.ft. was completed. Extensive main-laying has been carried out during the last few years over the quickly growing district.

THE GLOVER-WEST PLANT.

The installation of Glover-West verticals consists of three settings, each of four retorts, arranged in units of two retorts each. The retorts are of the 33 in. standard "New Model," elliptical section except at the base, where they expand rapidly into the circular steaming chamber characteristic of the system.

The retort house, which is of steel-framed, brick-panelled design, is built partly in the original horizontal retort house and partly in the adjoining coal-store, leaving space for a further plant of equal capacity. A temporary gabling is left for the extension.

Coal is brought to the plant in 12-ton railway wagons, which are discharged by a hydraulic tipper into a receiving hopper below the rails. Thence it is fed mechanically to a breaker capable of reducing 25 tons per hour to 2 in. cube. A West lip-bucket conveyor receives the broken coal and elevates it to, and distributes it in, the coal bunkers above the retort bench, where 48 hours' supply is stored. The same conveyor receives coke from the base of the retorts, and elevates and delivers it to hoppers either for producer feed or for sale. Breeze is separated from the coke by means of a bar screen placed in the coke chute, the gas from the retorts passing through a retort house governor to the works mains by way of a syphon in the yard.

The coal and coke handling machinery is driven by 15 H.P. Marshall vertical steam engines in duplicate; the gearing being so arranged that either engine may drive either the conveyor or the breaker. Duplicate 4 H.P. engines of the same type are provided for the coke extractor drive.

Adjoining the engine house there is a messroom and a bathroom for the men; the building being built in the same style as the retort house, but finished inside with glazed tiles.

THE RAVINE SEAM OF THE LANCASHIRE COALFIELD.

Fuel Research Board Report.

H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, have published, at 1s. 6d. net, "Fuel Research: Physical and Chemical Survey of the National Coal Resources No. 9—The Lancashire Coalfield, the Ravine Seam; Part II., Carbonization in Continuous Vertical Retorts."

The coal taken for the investigation was obtained from the Bickershaw district. Its analysis is given in the report, and its behaviour in the Gray-King carbonization assay apparatus described. In the latter it yields a black shrunken coke with very small pores. The coal shows but little swelling on carbonization.

The carbonizing tests were carried out at the Fuel Research Station in the setting of four continuous vertical retorts (Glover-West) on uniform consignments of coal. Three tests were run—one for 120 hours with 5 p.ct. of steam, one for 72 hours with 5 p.ct. of steam, and one for 120 hours with 20 p.ct. of steam. To obtain data regarding the gas yield when steam was not in use, a run of four hours' duration was arranged under special conditions which are described in the report; but owing to the danger of overheating the bottom castings, a full test could not be carried out without steam.

The general effect of steaming on the yields of products may be summarized as follows for increases from 5 to 20 p.ct. of steam.

Test No.	1.	3.	Increase	
Steam P.Ct.	5·0.	20 0.	Actual.	P.Ct.
Gas, c.ft. per ton	13,790	18,960	5170	37·5
Gas, B.Th.U. per c.ft.	501	450	— 51	— 10·2
Gas, therms per ton	69·1	85·3	16·2	23·4
Tar, gals. per ton	12·61	12·75	0·14	1·1
Ammonium sulphate, lbs. per ton	14·10	17·70	3·60	25·5

The chief points of interest in these results are, first, the very small percentage increase in the tar yield for an increase in steaming from 5 to 20 p.ct.; and, secondly, the comparatively low yield of gas with 5 p.ct. steaming, with the consequent high percentage increase in gas yield on carbonizing with 20 p.ct. steaming.

The increase in the gas yields from no steam to 20 p.ct., as determined by special runs, was 7180 c.ft., or 25·5 therms, as compared with 5170 c.ft. or 16·2 therms shown above for increases from 5 to 20 p.ct. of steam.

The following table summarizes the comparison drawn regarding the effect of steaming Ravine coal and several other coals already examined at H.M. Fuel Research Station.

Coal	"Consett" Durham)	"Mitchell Main Gas" (Parkgate Seam, Yorkshire).	Main and Ell (Lanarkshire).	"Meiros" (Pentre and No. 3 Rhondda Seams, South Wales).	Ravine (Lancashire).
Gas—					
Yield with no steam, c.ft.	13,260	13,100	11,800	12,000	11,780
,, ,, ,, therms	67·6	71·3	61·1	65·0	59·8
Increase with 20 p.ct. steaming, c.ft.	3,820	9,480	6,650*	7,210	7,180
Increase with 20 p.ct. steaming, therms	11·4	32·5	18·6*	23 0	25·5
Increase with 20 p.ct. steaming, therms p.ct.	16·9	45·6	30·5*	35·4	42·6

* *Nil* to 22 p.ct. of steam.

Coal	"Consett" (Durham	"Mitchell Main Gas" (Parkgate Seam, Yorkshire).	Main and Ell (Lanarkshire).	"Meiros" (Pentre and No. 3 Rhondda Seams, South Wales).	Ravine (Lancashire).
Tar—					
Yield with no steam, gals.	8·4	9·3	14·1	..	..
Increase with 20 p.ct. steaming, gals.	1·6	3·1	3·8*	..	..
Increase with 20 p.ct. steaming, p.ct.	19·0	33·3	27·0*	..	..
Increase from 5 to 20 p.ct. steaming, gals.	1·1	0·8	..	2·56	0·24
Increase from 5 to 20 p.ct. steaming, p.ct.	12·4	6·9	..	27·8	1·9
Coke—					
Pounds of coke consumed per 1000 c.ft. of additional gas per ton of coal, 5 to 20 p.ct. steam	7·1	11·6	21·1*	14·7	13·9

* *Nil* to 22 p.ct. of steam.

GAS UNDERTAKINGS RETURN FOR 1926.

PART I.—MANUFACTURE AND SUPPLY OF GAS.

The first part of the Board of Trade Return relating to all Authorized Gas Undertakings in Great Britain for the year 1926 has just been issued by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, and Branches, at the price of 5s. net. Part I. is that which contains particulars relating to the manufacture and supply of gas.

The corresponding part of the return for 1925 dealt with 781 undertakings. Since the date of issue of that, four undertakings have been absorbed by others. These are the Arlesey undertaking, absorbed by the Biggleswade and District Gas Company, Ltd.; the Brentford undertaking, by the Gas Light and Coke Company; the Hatfield undertaking, by the Welwyn and Hatfield Gas Company, Ltd., and the Hightown undertaking, by the Liverpool Gas Company. On the other hand, seven new undertakings have been added to the return—namely, the Ludlow Union Gas Company, Ltd., Midhurst Gas Company, Ltd., Seaford Gas Company, Ltd., Uckfield Gas and Electricity Company, Cove and Kilcreggan Corporation, and the Blantyre and East Kilbride undertakings of the Lanark County Council. The total number of undertakings dealt with in the present return is therefore 784. The Bexhill Corporation have acquired the undertaking of the Bexhill Water and Gas Company, and the Newark Corporation the concern of the Newark Gas Company.

The particulars are for the calendar year 1926 in the case of undertakings in England and Wales, and for the twelve months ended May 15, 1926, for Scotland. In a number of cases in the year under review, testings of gas were suspended owing to the coal stoppage. In these instances an average calorific value is stated in the return if tests were made during one or more quarters, and a figure in brackets has been inserted to indicate the number of quarters on which the value given is based. The quantities of gas made are shown in cubic feet and also in therms, if testings of the gas supplied by the undertaking were made by the gas examiner appointed under the Gas Regulation Act throughout the year. In such cases the number of therms made is based on the average calorific value supplied as officially ascertained. The number of therms sold, based on the declared calorific value, is shown in all cases in which an undertaking is supplying on the thermal basis.

TOTALS FOR GREAT BRITAIN.

The comparative table reproduced herewith shows that the quantity of coal carbonized in 1926 by the authorized gas undertakings of Great Britain was 16,564,172 tons, of coke employed for the manufacture of water gas 1,435,572 tons, and of oil used 97,703,394 gallons. The quantity of coal gas made was 226,572,490,000 c.ft., and of water gas 65,309,753,000 c.ft. The total quantity made (including 4,199,765,000 c.ft. of "other gas") was 296,082,008,000 c.ft. The gas sold totalled 276,568,647,000 c.ft., divided up as follows: Prepayment consumers, 99,301,381,000 c.ft.; ordinary and power consumers, 168,104,527,000 c.ft.; and public lamps 9,162,739,000 c.ft. The residuals made were: Coke and breeze, 11,176,933 tons; tar, 187,545,592 gallons; and sulphate of ammonia, 116,264 tons. The prepayment consumers numbered 4,579,691, and the ordinary consumers 3,824,870. The total mileage of mains was 44,470½.

SALE OF GAS OVER 4 P.CT. UP.

The table enables these figures to be compared with those of the six immediately preceding years; and looking at the statistics for 1926 and 1925, it will be seen that the quantity of gas made during 1926 was 12,263,700,000 c.ft. (4·3 p.ct.) in excess of that in 1925. A decrease (4,775,191,000 c.ft., or 2·06 p.ct.) occurred in the quantity of coal gas made; but the water gas increased by 17,136,462,000 c.ft., or 35·6 p.ct. The coal carbonized was less than in 1925 by 467,000 tons; but 282,159 tons more of coke and 36,320,745 gallons more of oil were used in the manufacture of water gas. The coke and breeze made in 1926 was less than that made in 1925 by 221,449 tons, and the tar was less by 6,622,712 gallons; these reductions corresponding closely with the decrease in the quantity of coal carbonized. The quantity of gas sold increased by 10,811,294,000 c.ft., or 4·07 p.ct. The number of consumers increased by 204,106, or 2·49 p.ct.; their average consumption increasing by 2 p.ct.

FIGURES FOR ENGLAND AND WALES AND SCOTLAND.

There are given in the comparative table the totals for the whole of the authorized gas undertakings in Great Britain. The separate figures for England and Wales and for Scotland for the last three years are as follows:

1926.

England and Wales.—Coal carbonized, 14,972,314 tons; coke for water gas, 1,401,232 tons; oil used, 97,388,134 gallons. Coal gas made, 204,491,813 c.ft.; water gas, 63,685,177,000 c.ft.; total gas made, 272,376,668,000 c.ft. Sold to prepayment consumers, 92,717,289,000 c.ft.; to ordinary and power consumers, &c., 154,232,476,000 c.ft.; for public lamps, 8,016,187,000 c.ft.; total quantity sold, 254,965,952,000 c.ft. Coke and breeze made, 10,178,658 tons; tar, 163,967,049 gallons; and sulphate of ammonia, 98,757¾ tons. Number of prepayment consumers, 4,260,199; ordinary consumers, 3,335,756; total number of consumers, 7,595,955. Length of gas mains, 40,860½ miles.

Scotland.—Coal carbonized, 1,591,858 tons; coke for water gas, 34,340 tons; oil used, 315,260 gallons. Coal gas made, 22,080,677,000 c.ft.; water gas, 1,624,576,000 c.ft.; total gas made, 23,705,340,000 c.ft. Sold to prepayment consumers, 6,584,092,000 c.ft.; to ordinary and power consumers, &c., 13,872,051,000 c.ft.; for public lamps, 1,146,552,000 c.ft.; total quantity sold, 21,602,695,000 c.ft. Coke and breeze made, 998,275 tons; tar, 23,578,543 gallons; sulphate of ammonia, 17,506¼ tons. Number of prepayment consumers, 319,492; ordinary consumers, 489,114; total number of consumers, 808,606. Length of gas mains, 3610 miles.

1925.

England and Wales.—Coal carbonized, 15,483,446 tons; coke for water gas, 1,119,452 tons, oil used, 61,217,483 gallons. Coal gas made, 210,156,509,000 c.ft.; water gas, 46,646,040,000 c.ft.; total gas made, 261,099,797 c.ft. Sold to prepayment consumers, 86,501,296,000 c.ft.; to ordinary and power consumers, &c., 149,774,319,000 c.ft.; for public lamps, 8,839,808,000 c.ft.; total quantity sold, 245,115,423,000 c.ft. Coke and breeze made, 10,459,165 tons; tar, 171,777,349 gallons; sulphate of ammonia, 109,243¾ tons. Number of prepayment consumers, 4,136,354; ordinary consumers, 3,264,355; total number of consumers, 7,400,709. Length of gas mains, 39,677¾ miles.

Scotland.—Coal carbonized, 1,547,726 tons; coke for water gas, 33,961 tons; oil used, 165,166 gallons. Coal gas made, 21,191,172,000 c.ft.; water gas, 1,527,251,000 c.ft.; total gas made, 22,718,511,000 c.ft. Sold to prepayment consumers, 6,245,991,000 c.ft.; to ordinary and power consumers, &c., 13,284,762,000 c.ft.; for public lamps, 1,111,177,000 c.ft.; total quantity sold, 20,641,930,000 c.ft. Coke and breeze made, 939,217 tons; tar, 22,390,955 gallons; sulphate of ammonia, 16,631¼ tons. Number of prepayment consumers, 310,264; ordinary consumers, 489,482; total number of consumers, 799,746. Length of gas mains, 3500¼ miles.

1924.

England and Wales.—Coal carbonized, 15,770,012 tons; coke for water gas, 947,189 tons; oil used, 45,242,865 gallons. Coal gas made, 211,084,643,000 c.ft.; water gas, 37,918,918,000 c.ft.; total gas made, 253,075,066,000 c.ft. Sold to prepayment consumers, 82,879,003,000 c.ft.; to ordinary and power consumers, &c., 145,430,758,000 c.ft.; for public lamps, 8,522,271,000 c.ft.; total quantity sold, 236,832,032,000 c.ft. Coke and breeze made, 10,699,716 tons; tar, 172,805,085 gallons; sulphate of ammonia, 108,436½ tons. Number of prepayment consumers, 4,036,251; ordinary consumers, 3,161,325; total number of consumers, 7,197,576. Length of gas mains, 38,548½ miles.

Scotland.—Coal carbonized, 1,559,168 tons; coke for water gas, 29,177 tons; oil used, 217,744 gallons. Coke gas made, 20,801,393,000 c.ft.; water gas, 1,349,302,000 c.ft.; total gas made, 22,150,773,000 c.ft. Sold to prepayment consumers, 5,660,749,000 c.ft.; to ordinary and power consumers, &c., 13,318,160,000 c.ft.; for public lamps, 1,080,981,000 c.ft.; total quantity sold, 20,059,890,000 c.ft. Coke and breeze made, 957,749 tons; tar, 22,452,193 gallons; sulphate of ammonia, 16,300½ tons. Number of prepayment consumers, 304,332; ordinary consumers, 491,878; total number of consumers, 796,210. Length of gas mains, 3436½ miles.

COMPANIES AND LOCAL AUTHORITIES.

In the return for 1926, the undertakings in the hands of companies and of local authorities are divided thus:

England and Wales.—459 companies; 249 local authorities.
Scotland.—4 companies; 72 local authorities.

DECLARATIONS OF CALORIFIC VALUE.

The first column of figures is devoted to the declared and the average (when the latter has been officially ascertained) calorific values of gas supplied. When noticing the returns for the five preceding years, lists were given of the following numbers of undertakings which had made declarations of calorific value; 1921, 184 undertakings; 1922, 162 undertakings; 1923, 134 undertakings; 1924, 49 undertakings; and 1925, 42 undertakings. To these may now be added the undertakings mentioned below, with their declarations in B.Th.U. made in 1926:

Audley, 450	Helston, 500	Ossett, 475
Bollington, 500	Ilkeston, 500	Oswaldtwistle, 480
Clitheroe, 500	Leigh, 420	Padiham, 475
Devizes, 425	Ormskirk, 450	Widnes, 475
Finedon, 500		

COMPARATIVE TABLE.

Year.	Number of Authorized Undertakings Included in Return.	Materials Used in Manufacture of Gas.			Quantity of Gas Made.			
		Coal Carbonized.	Coke for Water Gas.	Oil.	Coal Gas.	Water Gas.	Total Made.	
		Tons.	Tons.	Gallons.	1000 C.Ft.	1000 C.Ft.	1000 C.Ft.	Therms.
1920	798	17,566,316	‡	‡	214,703,118	36,932,530	*256,977,744	‡
1921	797	15,775,696	1,254,122	51,731,492	194,518,147	49,894,716	*249,019,732	‡
1922	796	15,907,095	1,057,909	46,145,160	201,963,546	43,946,129	*252,070,321	‡
1923	790	16,460,632	906,717	42,751,644	217,756,730	38,347,643	*259,849,536	‡
1924	784	17,329,180	976,366	45,460,609	231,886,036	39,268,220	*275,243,859	‡
1925	781	17,031,172	1,153,413	61,382,649	231,347,681	48,473,291	*283,818,308	‡
1926	784	16,564,172	1,435,572	97,703,394	226,572,490	65,309,753	*296,082,608	‡

Year.	Quantity of Gas Sold.					Quantity of Residuals Made.			Number of Consumers.		Length of Mains.
	To Prepayment Consumers.	To Ordinary and Power Consumers, &c.	For Public Lamps.	Total Sold.		Coke and Breeze.	Tar.	Sulphate of Ammonia.	Prepayment.	Ordinary.	
	1000 C.Ft.	1000 C.Ft.	1000 C.Ft.	1000 C.Ft.	Therms.	Tons.	Gallons.	Tons.			Miles.
1920	77,911,168	150,562,911	6,928,745	235,402,824	‡	‡	‡	‡	4,030,647	3,417,685	38,847
1921	80,285,658	141,768,032	7,023,422	229,077,112	§	10,404,702	160,376,472	115,979	4,071,220	3,488,090	39,547½
1922	78,224,063	146,174,788	8,203,938	232,602,789	§	10,475,155	169,770,531	113,373	4,137,009	3,535,137	40,231½
1923	82,404,187	150,256,712	8,965,704	241,626,603	§	11,098,169	181,962,574	117,166	4,231,243	3,579,107	40,984½
1924	88,539,752	158,748,918	9,603,252	256,891,922	§	11,657,465	195,257,278	124,737	4,340,583	3,653,203	41,985
1925	92,747,287	163,059,081	9,950,985	265,757,353	§	11,398,382	194,168,304	125,874½	4,446,618	3,753,837	43,178
1926	99,301,381	168,104,527	9,162,739	276,568,647	§	11,176,933	187,545,592	116,264	4,579,691	3,824,870	44,470½

* Including "Other gas," in 1920, 5,342,096,000 c.ft.; 1921, 4,606,869,000 c.ft.; 1922, 6,160,646,000 c.ft.; 1923, 3,745,163,000 c.ft.; 1924, 4,071,583,000 c.ft.; 1925, 4,237,336,000 c.ft.; and 1926, 4,193,765,000 c.ft. § Number of therms made and sold by all undertakings cannot be given. ‡ Information not available.

ALTERATIONS IN CALORIFIC VALUE.

In 1926 there were few instances of undertakings making alterations in the calorific values that had previously been declared by them. Such cases as did occur are shown below; and it will be noted that they are equally divided between increases and decreases.

Corsham Gas Company, Ltd.—from 500 to 540 B.Th.U.
Denny and Dunipace Corporation—from 550 to 500 B.Th.U.
Dover Gas Company—from 475 to 500 B.Th.U.
Hexham Gas Company—from 425 to 450 B.Th.U.
Hindley Urban District Council—from 475 to 425 B.Th.U.
Nuneaton Gas Company—from 280 to 200 B.Th.U.
Prescot Gas Company—from 420 to 450 B.Th.U.
Southport Corporation—from 500 to 470 B.Th.U.
Tamworth Gas Company—from 450 to 500 B.Th.U.
Wokingham Corporation—from 500 to 460 B.Th.U.

WATER GAS SUPPLIED.

As usual, there is set out in the second column of the return the proportion of water gas supplied by various undertakings; the maximum and average figures being given. The following cases (with their percentages) are noted in which the maximum proportion of water gas reached 25 p.ct.

During the year under review, of course, the quantity of water gas supplied was largely influenced by the coal strike.

Aberystwyth, max., 45; av., 33·4.
Abingdon, max., 46; av., 30.
Ackworth, &c., max., 30; av., 25.
Aldershot, max., 77·4; av., 32·5.
Ashford, max, 45; av., 17·8.
Bangor, max., 30; av., 20.
Barnet, max., 52·3; av., 27.
Barnsley, max., 76·8; av., 5·5.
Barrow, max., 44·3; av., not stated.
Barry, max., 60; av., 27·5.
Bath, max., 84·1; av., 40·7.
Batley, max., 35·9; av., 23·5.
Berkhampstead, max., 32; av., 9·2.
Bexhill, max., 39·5; av., 20·4.
Bideford, max., 61; av., 43·4.
Biggleswade, max., 25; av., 20.
Bilston, max., 64; av., 17·4.
Birkenhead, max., 55·4; av., 24·6.
Birmingham, max., 39; av., 20 6.
Bishop Auckland, max., 38; av., 16.
Bishop's Stortford, max., 65·9*; av., 39·8.*
Blackburn, max., 51·6; av., 15·5.
Blackpool, max., 35·9; av., 21·4.
Blaenavon, max., 43; av., 35.
Bournemouth, max., 57; av., 44·6.
Brentwood, max., 40; av., 12·8.
Bridlington, max., 82·5; av., 51·1.
Brierley Hill, max., 57; av., 32.
Brighton and Hove, max., 52; av., 41·1.
Bristol, max., 49·6; av., 32·6.
Budleigh Salterton, max., 30; av., 22.
Burnham (Somerset), max., 33; av., 28·25.
Burnley, max., 74·2; av., 41·8.
Burton-upon-Trent, max., 56; av., 21·9.
Caernarvon Corporation, max., 30; av., 25.
Cambridge, max., 33; av., 32·3.
Cardiff, max., 57·1; av., 30·3.
Chelmsford, max., 28; av., 16.
Chesham, max., 52; av., 31.
Chesterfield, max., 37; av., 8·4.
Chichester, max., 53·25; av., 36·7.
Chorley, max., 42; av., 12·25.
Cirencester, max., 45; av., 32.
Clacton, max., 61·9; av., 43.
Cleator Moor, max., 49·5; av., 35·7.
Cleveland, max., 50; av., 35.
Colchester, max., 52·4; av., 29·9.
Colne, max., 60; av., 45.
Colwyn Bay, max., 80; av., 41.
Commercial Gas Company, max., 45·9; av., 22·6.
Conway, max., 40; av., 33·3.
Coventry, max., 45·4; av., 20·4.
Crowborough, max., 46·3; av., 31.
Croydon, max., 61·1; av., 41·7.
Deal and Walmer, max., 45; av., 37.
Derby, max., 51; av., 24·1.
Devizes, max., 54; av., 15.
Doncaster, max., 62·1; av., 48·7.
Dorchester, max., 50; av., 37·3.
Dorking, max., 70·4; av., 44·4.
Dover, max., 38; av., 13.
Dudley, max., 52·5; av., 18.
Durham, max., 54·6; av., 15 25.
Eastbourne, max., 38; av., 27.
East Grinstead, max., 50; av., 28·8.
East Hull, max., 51; av., 36·5.
Exmouth, max., 47·1; av., 32·4.
Falmouth, max., 32·5; av., 18·6.
Faversham, max., 45; av., 30.
Felixstowe, max., 52·6; av., 35·8.
Fleetwood, max., 49·6; av., 33 9.
Folkestone, max., 27·6; av., 14·5.
Gas Light and Coke Company max., 57·5; av., 40·2.
Glossop, max., 30; av., 23.
Gloucester, max., 47·75; av., 29.
Gorleston and Southtown, max., 32; av., 19.
Gosport, max., 69·7; av., 47·2.
Gravesend and Milton, max., 72·2; av., 24·4.
Grays and Tilbury, max., 50; av., 25·6.
Great Yarmouth, max., 65; av., 27·3.
Guildford, max., 60; av., 36.
Halstead, max., 25; av., 20.
Hampton Court, max., 61·6; av., 41·4.
Harpenden, max., 44; av., 30.
Harrogate, max., 30; av., 25.
Hartlepool, max., 100; av., 52.
Harwich, max., 50; av., 23.
Haslemere, max., 35; av., 20.
Haslingden, max., 33·3; av., 20.
Hastings and St. Leonards, max., 55·4; av., 39·1.
Hebden Bridge and Mytholmroyd, max., 30·6; av., 12·5.
Hemel Hempsted, max., 45·3; av., 35·4.
Hereford, max., 66·8; av., 31·5.
Hertford, max., 56; av., 34.
Hessle, max., 54·4; av., 28·5.
Heywood, max., 29·5; av., 9·9.
Hinckley, max., 31·6; av., 12·2.
Hoddesdon, max., 25; av., 15.
Honley, max., 52·4; av., 35.
Horley, max., 38; av, 23.
Hornsey, max., 68; av., 48.
Horsham, max., 55; av., 47.
Hull (British Gas Light), max., 54; av., 34·5.
Ipswich, max., 46·2; av., 25·5.
Irthlingborough, max., 50·3; av., 45·8.
Kendal, max., 55; av., 20.
Kettering, max., 34·8; av., 34·5.
Kidderminster, max., 30; av., 24·5.
Kidsgrove, max., 100; av, 30.
King's Lynn, max., 77; av., 41.
Kingston-upon-Thames, max., 54; av., 35.
Lancaster, max., 54; av., 10·9.
Lea Bridge, max., 61·9; av., 49.
Leamington, max., 73; av., 25.
Leeds, max., 54·9; av., 21·2.
Leicester, max., 39·6; av., 13·5.
Leigh, max., 50·4; av., 12·3.
Leighton Buzzard, max., 47; av., 13.
Lewes, max., 25; av., 16.
Lincoln, max., 66·1; av., 31·2.
Liverpool, max., 60·3; av., 41.
Llandudno, max., 30; av., 30.
Llanelly, max., 71·1; av., 60.
Llynvi Valley, max., 35; av., 25.
Long Eaton, max., 64; av., 21.
Loughborough, max., 62·8; av., 41.
Lowestoft, max., 50·7; av., 34·8.
Lymm, max., 66; av., 46.
Macclesfield, max., 60; av., 4·5.
Maidstone, max., 37·7; av., 29·1.
Malton, max., 60·8; av., 32·6.
Mansfield, max., 52; av., 32.
Marlborough, max., 70; av., 17.
Merthyr Tydfil, max., 46·9; av., 22·3.
Middlesbrough, max., 87.1; av., 37·7.
Mid-Kent Gas Light Company, max., 36·9; av., 28·7.
Morecambe, max., 49·6; av., 13·1
Newark, max., 35; av., 25.
Newcastle-under-Lyme, max., 31·5; av., 24·5.
Newcastle-upon-Tyne, max., 36·6; av., 20·2.
Newport (Mon.), max., 59·8; av., 39·6.
Newport Pagnell, max., 41; av., 25.
Newquay (Cornwall), max., 30; av., 20.
Normanton, max., 42; av., 31.
North Middlesex Gas Company, max., 77; av., 58·7.
Norwich (British Gas Light), max., 44; av., 24·5.
Nottingham, max., 26·5; av., 9·6.
Oldbury, max., 51·3; av., 20·6.
Oldham, max., 66; av., 18·7.
Ormskirk, max., 29·2; av., 7·8.
Otley, max., 43; av., 16·4.
Peterborough, max., 56·8; av., 33.
Pinner, max., 50; av., 39·5.
Plymouth Corporation, max., 74·6; av., 49·9.
Plymouth and Stonehouse Gas Company, max., 62; av., 47·4.
Pontefract, max., 50; av., 40.
Pontypool, max., 30; av., 15.
Pontypridd, max., 48; av., 1·5.
Porthcawl, max., 49; av., 30.
Portsmouth, max., 58·1; av., 40·1.
Port Talbot, max., 30; av., 24.
Preston, max., 66; av., 39.
Ramsgate, max., 52·4; av., 17·7.
Reading, max., 69·6; av., 40·3.
Redditch, max., 68·2; av., 24·1.
Redhill, max., 69·7; av., 45·6.
Rhondda, max., 32·9; av., 10·7.
Rhyl, max., 51; av., 29.
Rochdale, max., 54·7; av., 26·9.
Rochester, Chatham, &c., max., 50; av., 37·9.
Romford, max., 43·5; av., 25.
Rossendale Union, max., 38; av., 23.
Rugby, max., 76·6; av., 50·6.
Rushden and Higham Ferrers, max., 65·1; av., 39·4.
St. Albans, max., 54; av., 31·7.
Salisbury, max., 41; av., 18.
Sandbach, max., 25; av., 10.
Scarborough, max., 68; av., 56.
Seaford, max., 50; av., 20.
Seaham, max., 86·8; av., 37·3.
Selby, max., 44; av., 28.
Sevenoaks, max., 50; av., 32.
Shanklin, max., 40; av., 22.
Sheffield, max., 27·3; av., 9·7.
Sheppey Gas Company, max., 40; av., 28.
Sheringham, max., 25; av., 20.
Shrewsbury, max., 43·2; av., 15 6.
Sittingbourne, max., 29; av., 27.
Smethwick, max., 50·8; av., 16·9.
Southampton, max., 63·3; av., 47·7.
South Elmsall, max., 30; av., 14.
Southend, max., 50; av., 49.
Southgate, max., 66·6; av., 52.
Southport, max., 43·9; av., 27·6.
South Shields, max., 76·33; av., 33·8.

* One station only out of four.

South Suburban Gas Company, max., 38·8; av., 29·1.
Spalding, max., 87; av., 46.
Spennymoor and Tudhoe, max., 75; av., 21·7.
Stafford, max., 25; av., 25.
Stockport, max., 50; av., 18.
Stockton-on-Tees, max., 77·6; av., 16·6.
Stoke-on-Trent, max., 71·8; av., 29·7.
Stourbridge, max., 50; av., 23.
Sunderland, max., 78; av., 39.
Swansea, max., 48; av., 42.
Swindon, max., 33·6; av., 17·4.
Swinton and Mexborough, max., 80; av., 33.
Taunton, max., 80; av., 25·3.
Teignmouth, max., 60; av., 49.
Tendring Hundred Company (Walton-on-Naze), max., 50; av., 31·7.
Thirsk, max., 33·3; av., 33·3.
Tonbridge, max., 60; av., 56.
Torquay Corporation, max., 74·6; av., 59·9.
Tottenham, max., 78; av., 39.
Trowbridge (British Gas Light), max., 51·8; av., 24·5.
Tunbridge Wells, max., 63; av., 46·6.
Tynemouth, max., 60; av., 26.
Uxbridge, Maidenhead, and Wycombe, max., 77·7; av., 45.
Wakefield, max., 58·4; av., 22·2.
Walsall, max., 38·9; av., 21·2.
Waltham and Cheshunt, max., 48; av., 43.
Walton-on-Thames and Weybridge, max., 41; av., 27.
Wandsworth, Wimbledon, and Epsom, max., 43·2; av., 21·8.
Ware, max., 58·6; av., 39·4.
Warminster, max., 30; av., 20.
Warrington, max., 29; av., 14.
Warwick, max., 36; av., 9·4.
Watford, max., 67·5; av., 38·9.
Wath, Bolton, and Thurnscoe, max., 89·1; av., 78·6.
Wellingborough, max., 65; av., 53.
Wellington (Salop), max., 68; av., 48·5.
Wells, max., 36·5; av., 19·75.
West Bromwich, max., 33; av., 14·6.
Westgate and Birchington, max., 75; av., 47·5.
Weston-super-Mare, max., 68·1; av., 35·6.
Weymouth, max., 80; av., 46.
Widnes, max., 25·1; av., 15·1.
Wigan, max., 45; av., 23.
Willenhall, max., 58; av., 17·7.
Winchester, max., 62; av., 48.
Wirksworth, max., 50; av., 20.
Woking, max., 37·7; av., 20·1.
Wokingham, max., 63; av., 40.
Wolstanton, max., 57·4; av., 24·8.
Wolverhampton, max., 53·4; av., 35·2.
Woolton, max., 29; av., 17.
Worthing, max., 51·3; av., 36·2.
Yeadon and Guiseley, max., 69; av., 37.
Yeovil, max., 75; av., 23·4.
York, max., 40·4; av., 13·2.
Yorktown and Blackwater, max., 27·7; av., 6·9.
Airdrie, max., 40; av., 30.
Ardrossan, max., 33·1; av., 25·1.
Blantyre, max., not stated; av., 33·3.
Burntisland, max., 30; av., 30.
Edinburgh, max., 37·6; av., 20·9.
Greenock, max., 25·5; av., 13·7.
Kilmarnock, max., 40; av., 35.
Kirkintilloch, max., 50; av., 45.
Newport (N.B.), max., 41·4; av., 33·9.
Stirling, max., 50·2; av., 45.
Tayport, max., 40; av., 25.

OTHER GAS.

Of the 4,199,765,000 c.ft. of "other gas" produced by the various undertakings in 1926, the South Staffordshire Mond Gas Company were responsible for no less than 3,175,745,000 c.ft. The output of the Mond Gas Company in 1925 was 2,929,929,000 c.ft. The remainder of the "other gas" was largely made up of Tully gas and mixed coal and water gas. The total of gas made shown in the return, of course, includes this "other gas" which is additional to the items of "coal gas" and "water gas."

GAS IN BULK.

Tables are included which show the gas sold in bulk to authorized gas undertakings by other undertakings, and that similarly bought by undertakings. The figures are included only once in the return—*i.e.*, as made by the selling undertaking, and as sold to consumers by the purchasing undertaking. The gas so sold amounted to 652,507,000 c.ft.; while the purchases totalled 661,229,000 c.ft. The biggest figures in these tables are:

Gas Sold to Authorized Undertakings.

Selling Undertaking.	C.Ft.
Hull (British Gas Light Company, Ltd.)	69,055,000
Otley Gas Company	22,301,000
Rhymney and Aber Gas Company	53,671,000
Watford Gas and Coke Company	94,803,000
Windsor Royal Gaslight Company	25,443,000
Bothwell and Uddingston Undertaking (Lanark County Council)	244,878,000

Gas Bought by Authorized Undertdkings.

Purchasing Undertaking.	C.Ft.
Bedwellty U.D.C.	53,671,000
Burley-in-Wharfedale U.D.C.	21,730,000
Hull Corporation	69,055,000
Mynyddislwyn U.D.C.	23,737,000
Rickmansworth U.D.C.	72,055,000
Uxbridge, Maidenhead, Wycombe, and District Gas Company	59,562,000
Bellshill and Mossend Undertaking (Lanark County Council)	83,532,000
Holytown, New Stevenston, and Carfin Undertaking (Lanark County Council)	35,991,000
Larkhill Undertaking (Lanark County Council)	86,531,000

COKE-OVEN GAS SUPPLIES.

The total quantity of gas bought from owners of coke ovens by authorized gas undertakings also reveals an effect of the coal stoppage; the total being less than one-half what it was for 1925. This gas appears in the return as sold to consumers by those undertakings. The following are the figures contained in the table:

Purchasing Undertaking.	Quantity of Gas Involved.
	C.Ft.
Castleford and Whitwood Gaslight and Coke Company	62,230,000
Chesterfield Corporation	101,791,000
Dinnington and District Gas Company, Ltd.	29,170,000
Eckington and Mosborough Gas Company, Ltd.	26,204,000
Houghton-le-Spring District Gas Company	20,698,000
Kidsgrove Gaslight Company	22,424,000
Leeds Corporation	118,587,000
Little Hulton U.D.C.	10,080,000
Manchester Corporation	1,226,000
Middlesbrough Corporation	380,866,000
Ossett Corporation	82,376,000
Pontypridd U.D.C.	72,079,000
Port Talbot Corporation	36,484,000
Rhymney and Aber Gas Company	274,564,000
Rotherham Corporation	138,623,000
Sheffield Gas Company	689,495,000
Staveley Gas Light and Coke Company, Ltd.	14,196,000
Stocksbridge Gas Company	31,261,000
Swinton and Mexborough Gas Board	29,557,000
Wath, Bolton, and Thurnscoe Gas Board	51,459,000
Wombwell U.D.C.	31,806,000
Glasgow Corporation	96,671,000
Total	2,321,850,000

The total compares with a figure of 4,797,752,000 c.ft. of coke oven gas purchased by gas undertakings in the same way in 1925, 4,470,914,000 c.ft. in 1924, 4,268,055,000 c.ft. in 1923, 3,635,678,000 c.ft. in 1922, and 1,325,027,000 c.ft. in 1921. There is on the present occasion one name added to the list of purchasing undertakings—that of the Glasgow Corporation.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Price of Cast-Iron Pipes: A Fallacy Refuted.

SIR,—I have recently received a letter from an engineer well-known in the industrial and gas world, which sets out a series of well-reasoned arguments to show that in national interests purchasers of materials should, as far as possible, refrain from buying abroad; and saying that in the case of cast-iron pipes buyers are inclined to introduce competition from abroad in consequence of an alleged existence in this country of an Association for controlling prices of the home-made product.

On making inquiries further afield, I find the belief to be prevalent that the price of British-made cast-iron pipes is controlled by, or in some way regulated among, the several makers.

I would therefore like emphatically to state that since the Cast-Iron Pipe Association was dissolved some four years ago, prices have been free, and in no way controlled.

Probably in no article of commerce does the direct cost of wages absorb so large a portion of the selling price of an article as does the cast-iron pipe and the raw materials required in its production. In short, it takes 7 tons of British material to produce 1 ton of cast-iron pipes. It follows therefore that, for every 1 ton of pipes imported, the country is deprived of the wages paid in the getting and manufacture of 8 tons of materials; wages paid, direct and indirect, representing by far the greater portion of the selling price.

Is it possible to advance a stronger plea for giving preference to British cast-iron pipes, which are excluded by tariff walls from entering the countries of their competitors?

E. J. FOX,
Managing Director.

The Stanton Ironworks Company, Ltd.,
Near Nottingham,
Aug. 9, 1927.

Gas Cheaper at Wombwell.—The Wombwell Urban District Council have agreed to reduce the price of gas, by 3d. per 1000 c.ft. to consumers of 20,000 c.ft. per quarter; by 4d. to consumers of 30,000 c.ft., by 5d. to consumers of 40,000 c.ft., by 6d. to consumers of 60,000 c.ft., by 9d. to consumers of 80,000 c.ft., by 1s. to consumers of 100,000 c.ft., and by 1s. 6d. to consumers of 200,000 c.ft. The present charge for gas is 5s. 3d. per 1000 c.ft.

Stirling Gas Light Company.—At the annual meeting of the Stirling Gas Light Company—Mr. George Forsyth presiding—the report showed that the balance carried from revenue to profit and loss account amounted to £4944, as compared with £8978 last year. The Directors, notwithstanding the losses sustained, recommended payment of the same dividend as last year, without encroaching on reserves. The balance available amounted to £9181. Out of this there had been paid a dividend on the preference shares and an interim dividend of 4s. 3·597d. per share on the new capital, which left a balance of £6450. The Directors recommended a final dividend of 6s. 0·235d. per share on the original capital, and 7s. per share on the new ordinary capital, carrying £136 to reserve. The balance carried forward is £3035, as compared with £878.

MISCELLANEOUS NEWS.

BUILDING COLLAPSE AND ROAD SUBSIDENCE IN CORNHILL.

Little Damage to Gas Mains.

The collapse of part of the offices of the Commercial Union Assurance Company early on the morning of Aug. 7 was accompanied by a subsidence of the subsoil of Cornhill; the ground on the south side of the road for a length of some 30 yards sliding into the excavation which had been made for the new offices of Lloyds Bank.

The concrete surface of the road did not give way, but the sewer was fractured—the side falling out. The telephone cables were carried down with the ground, and hung in a long loop.

The 24-in. gas main near the centre of the road could be seen hanging below the concrete; several pipes being exposed. The only apparent escape of gas was in Change Alley, where a 3-in. main had been damaged by the falling stonework. This main was cut off and capped up, and the 24-in. gas main, in common with the water, hydraulic power, and electric mains, was cut off clear of the subsidence, as a precautionary measure.

The accompanying photograph conveys some idea of the havoc wrought.

BRITISH INDUSTRIES FAIR.

The management of the Heavy Section of the British Industries Fair report that the space definitely booked for the 1928 display in Birmingham is some 5400 sq. ft. in excess of the total space occupied by the entire exhibition in that city last February. This position, attained a full six months prior to the opening, constitutes a new record in the history of the Fair. It is the more remarkable in view of the great extensions, totalling 120,000 sq. ft., at a cost of £30,000, which were carried out for the 1927 Fair, when, notwithstanding this increase of area, every available foot was occupied. Ninety-three per cent. of the exhibitors of last February have again booked their positions—no fewer than 178 firms having applied for larger space, chiefly for the purpose of additional working exhibits. Extensions are being carried out; and the first of these, totalling 70,000 sq. ft., will establish a permanent and uniform building-line throughout the length of the Fair to a distance of a third of a mile. Provision has been made for the addition of a further 35,000 sq. ft. Stronger evidence of the growing success year by year of the Heavy Section of the Fair is to be found in the arrangement just completed by the Birmingham Chamber of Commerce, under which the site of the Exhibition buildings is definitely secured for fifteen years ahead.

Leeds Corporation and the Crossgates Undertaking.—The Leeds Corporation Gas Department are to acquire the undertaking of the Crossgates, Halton, and Seacroft Gas Company, Ltd., as from Jan. 1, 1928. Meanwhile the Corporation Gas Department are offering to sell or let on hire gas appliances to consumers of the Company's area on the same terms as operate in the Corporation's general area of supply; and on Aug. 11 the Corporation opened a special showroom.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Aug. 10.]

Nos. 20,295—20,807.

BELLAY, J.—"Gas generator." No. 20,764.
CEZANNE, R. M. A. E.—"Gas producers." No. 20,467.
EICKWORTH, R.—"Gas burners." No. 20,725.
HELPS, A. M.—"Gas burners and hotplates." No. 20,528.
HUMPHREYS & GLASGOW, LTD.—"Multipass gas condensers." No. 20,495.
KING, J. G.—"Treatment of coal." No. 20,595.
LANDER, C.—See King, J. G. No. 20,595.
SINNATT, F. S.—See King, J. G. No. 20,595.

TRADE NOTES.

Stanton Cast-Iron Pipes.

The Stanton Ironworks Company has published a list of the cast-iron pipes which they can offer for immediate delivery this month. The firm's output of cast-iron pipes exceeds 200,000 tons per annum.

Joseph Evans & Sons.

Messrs. Joseph Evans & Sons (Wolverhampton), Ltd., of Culwell Works, Wolverhampton, advise us that their London address is now No. 109, Kingsway, London, W.C. 2. Telephone, Holborn 1091, and telegraphic address, "Dryosbo, Westcent London;" their London Agents, Messrs. Dryden, Osborne, & Co., having removed from Craven House, Kingsway, to larger offices.

A serious surgical operation was delayed, at the Royal Lancaster Infirmary, last week, by a breakdown of electric current.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

After the more hopeful position of the last few weeks, the market has taken rather a disappointing turn. Orders for early shipment have gone off somewhat, and in some cases collieries which were getting rather better prices have had to reduce again. Inquiries for forward positions are still sufficient to encourage firm quotations, and fitters will not sell forward at the prices they are compelled to accept for prompt shipments. The recent improvement hardly got as far as the poorer classes of coal, and it is the weakness of the inferior qualities which is probably the chief obstacle to any sustained recovery.

Gas coals report a reasonably favourable position, Wear Specials and best qualities quoting 15s. 9d. to 16s. 3d. f.o.b., and seconds 14s. to 14s. 6d. Durham coking is still in very poor demand, and some brands are obtainable at 13s. 6d. for prompt, though 14s. is quoted for forward. Unscreened steams are weaker again; the inferior qualities being freely offered at 13s. 6d. to 14s., and better brands are down to 14s. 3d. to 14s. 6d. again. Northumberland steams still quote 14s. 6d. for best screened, but are obtainable at less than this through contractors.

Gas coke is clearing fairly satisfactorily at 20s. 6d. to 21s. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

The holiday season is, as usual, affecting the work of the collieries, and it will be some weeks before the trade settles down to something like normal conditions. There appears to be every indication that the winter house trade will start early this year, owing to small quantities which householders have purchased during the summer.

The most disappointing feature of the market is the depressed state of trade among industrial consumers, and all descriptions of this class of fuel are at prices in many cases below cost of production. With the lack of export business regular consumers, such as gas-works, are having the benefit of being able to purchase their requirements much cheaper than was apparent at the commencement of the year; and some contracts recently fixed show very lean figures to the supplying collieries.

The following are the Humber bunker and export prices f.o.b. usual shipping ports: South Yorkshire—Hards, Association, 16s. 7½d. to 16s. 10½d. per ton; screened gas coal, 15s. 6d. to 16s.; washed trebles, 17s. 3d. to 18s. 3d.; washed doubles, 16s. 6d. to 16s. 9d.; washed singles, 15s. 6d. to 15s. 9d.; washed smalls, 12s. to 12s. 3d.; rough slack, 10s. to 10s. 6d.; and smithy peas, 17s. 3d. to 18s. West Yorkshire—Hartleys, f.o.b. Goole, 15s. to 15s. 6d.; screened gas coal, 15s. to 15s. 9d.; washed trebles, 16s. to 16s. 6d.; washed doubles, 15s. 6d. to 15s. 9d.; washed singles, 15s.; washed smalls, 12s. to 12s. 3d.; unwashed trebles, 15s. to 15s. 6d.; unwashed doubles, 13s. 3d. to 13s. 9d.; and coking smalls, 11s. to 11s. 3d. Derbyshire and Nottinghamshire—Top hards, 17s. 6d. to 19s.; washed doubles, 16s. 3d. to 16s. 9d.; washed singles, 15s. 6d. to 15s. 9d.; washed smalls, 12s. to 12s. 3d.; and rough slack, 10s. 6d. to 11s. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 14s. 6d. to 15s.; gas coke, 19s. to 21s.; and furnace coke, 19s. to 20s.

The Manchester coal market remains quiet for all grades. Some spot lots are offered at 2s. below the market price. Average quotations are: Lancashire, best house, 32s. to 33s.; seconds, 29s. to 30s.; common, 19s. to 21s.; kitchen, 23s. to 24s. Yorkshire Haigh Moor, 32s. to 33s.; best house, 29s. to 30s.; cobbles, 18s. to 20s.; washed doubles, 13s. to 15s.; washed singles, 12s. to 14s.; and rough slack, 8s. to 10s. in wagons at the pit.

MIDLANDS.

All save a very small percentage of the annual gas coal contracts have now been fixed up. Those gas undertakings which refused to concede prices quoted by collieries in June profited by the continued decline of the market, effecting a saving of from 1s. to 2s. a ton on the prices previously ruling. The tonnages contracted for are smaller than usual. It does not appear that any greater margin has been reserved than in previous years; but there are, of course, undelivered balances on old contracts to be taken into account, and owing to the stoppage last year these are considerable in many cases.

Market conditions have been stagnant as regards industrial and household fuel. The August holiday interrupted the flow of orders from householders who had been stimulated to re-stock early. A few orders—the prelude to brisker conditions generally—are again beginning to come in, and there is no further giving-way of prices. Here and there pits which produce coal specially durable for stocking are working full time. Others are making about four days a week.

Nuts are moving off fairly well at from 12s. to 14s.; higher grades making 15s. There is no longer any suggestion of stringency with regard to slack. Quotations for good average rough samples range from 8s. to 10s.

Furnace coke has lost the firmness it showed a month ago. Contracts can again be made round 12s. 6d. at ovens.

New Price at Eastbourne.—The Eastbourne Gas Company have notified a resumption of the pre-strike charge for gas—viz., 9·4d. per therm, commencing with the present quarter. The Directors have also decided to pay an interim half-yearly dividend at the following rates: On the "A" stock, 8¼ p.ct.; on the "B" stock, 6¾ p.ct.; and on the 5 p.ct. preference stock, 5 p.ct.

Thorne Gas Undertaking and Doncaster Corporation.—The Thorne Gas Light and Coke Company have offered to dispose of their undertaking to the Doncaster Corporation. The Corporation have adjourned consideration of the matter with a view to an inspection of the undertaking by the Chairman of the Gas Committee and the Gas Engineer, and the submission of a report thereon.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Aug.* 15.

Pitch continues firm, and it is reported that business has been done at 92s. 6d. per ton f.o.b. makers' works.

Creosote is rather firmer at 8⅝d. to 8¾d. per gallon.

Pure toluole continues firm at about 2s. per gallon. Pure benzole is about 1s. 6d. per gallon, and 95/160 solvent naphtha 1s. 4d. to 1s. 5d. per gallon.

Tar Products in the Provinces.

Aug. 15.

The average values of gas-works products during the week were: Gas-works tar, 64s. 6d. to 69s. 6d. Pitch—East Coast, 90s. to 92s. 6d. f.o.b. West Coast—Manchester, 85s. to 87s. 6d.; Liverpool, 87s. 6d. to 90s.; Clyde, 89s. to 91s. 6d. Benzole, 90 p.ct., North, 1s. 2d. to 1s. 3d.; crude, 65 p.ct. at 120° C., 10¼d. to 10½d., naked at makers' works; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluole, naked, North, 1s. 4d. to 1s. 5d. nominal. Coal-tar crude naphtha, in bulk, North, 7¼d. to 8d. Solvent naphtha, naked, North, 10¼d. to 11¼d. Heavy naphtha, North, 1s. to 1s. 1d. Creosote, in bulk, North, liquid, 7¼d. to 7¾d.; salty, 7d. to 7¼d.; Scotland, 7¼d. to 7¾d. Heavy oils, in bulk, North, 8¼d. to 9¼d. Carbolic acid, 60 p.ct., 2s. 4½d. to 2s. 5d. prompt. Naphthalene, £11 to £14; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

CONTRACTS OPEN.

Neutralizing Apparatus.

Tenders are invited by the Middleton Gas Department for the supply of a neutralizing apparatus, &c. [See advert. on p. 407.]

Mainlaying, &c.

The Torquay and Paignton Gas Company are inviting tenders for laying and jointing a cast-iron main. [See advert. on p. 407.]

South Shields Gas Company.—Dividends at the following rates for the half-year ended June 30 have been paid by the South Shields Gas Company: On the consolidated stock, 4¼ p.ct.; on the new stock, 4¼ p.ct.; and on the ordinary stock 2⅞ p.ct.—all less income-tax.

Reduction in Price at Sunderland.—The Sunderland Gas Company have reduced the price of gas by 2d. per 1000 c.ft. as from the quarterly meter readings taken in June and July. This makes the new gross price 2s. 8d. per 1000 c.ft. for lighting, heating, and cooking (less the usual discounts ranging from 1d. to 6d., according to consumption), and 2s. 6d. for power purposes (less discounts ranging from 1d. to 7d., according to consumption).

Gas Prices at Hull.—The Directors of the British Gas Light Company, Ltd. (Hull Station), announce that, as and from the reading of the meter indices for the September quarter, the price of gas will be reduced from 8d. to 7½d. per therm. From and after the reading for the June quarter, the discounts of 5 p.ct. and 10 p.ct. hitherto allowed in respect of gas used for engines only will be discontinued, and the following scale of discounts will be put into operation for all gas consumed: Quarter's consumption of gas—287·5 to 575 therms, 5 p.ct. discount; exceeding 575 to 1150 therms, 10 p.ct.; and exceeding 1150 therms, 12½ p.ct. The discounts are subject to settlement of the account within 30 days of the date thereof.

The "Perfect Middle-Class Home."—Important conferences of specialists in dwelling-house construction as well as of housewives will be held at the Midland Building Trades Exhibition in Birmingham next month. The aim will be to recommend the best plans and practical ideas for the "perfect middle-class home." This will be one of the most interesting events at the exhibition, which will be held at Bingley Hall from Sept. 5 to 17. Ninety per cent. of the available stand space has already been allotted, all the trades connected with the building industry having combined to give the latest object lessons in materials, machinery, and fittings for the construction of dwelling-houses, factories, and public works. The same organization which is responsible for the great success of the British Industries Fair in Birmingham is carrying out the arrangements of the exhibition, with Mr. G. Henry Wright as Secretary, and Mr. Charles Stanley as General Manager.

Reductions in Scotland.—The Port-Glasgow Corporation Gas Committee have recommended a reduction in the price of 4d. per 1000 c.ft., which makes it 5s. 6d. per 1000 c.ft. The new rate will commence as from the September survey. The Glasgow Corporation Gas Committee have agreed to reduce the price from 5s. 2d. to 4s. 3·7d. per 1000 c.ft. At a recent meeting of the Kirkcudbright Town Council the Convener of the Gas Committee announced that the charge per 1000 c.ft. would be reduced, as from Aug. 1, from 8s. 9d. to 6s. 3d. for domestic purposes, and to 5s. 4d. for power. The Pitlochry Gas-light Company have lowered the price, by 10d., to 6s. 8d., which is equal to the lowest pre-war rate. At Perth the charge has been fixed at 1s. 1·3d. per therm, or 5s. per 1000 c.ft. As the rate last year was increased by 1s. 7d., the above represents a reduction of 9d. The Leven and Buckhaven Gas Commissioners intimate a further reduction of 10d. per 1000 c.ft. The Wick Gas Company have lowered the price from 7s. 1d. to 5s. 5d. per 1000 c.ft. The pre-strike rate was 5s. 10d. per 1000 c.ft. The Brechin Gas Company, Ltd., intimate that from the August survey the price of gas will be reduced by 10d. per 1000 c.ft. The present price is 5s. 5d. at Brechin and 6s. 5d. at Edzell, so that the new rate will be 4s. 7d. and 5s. 7d. The rate for slot meters will be reduced correspondingly, and the discounts to large consumers will be resumed from the same date.

STOCK MARKET REPORT.

In spite of the holiday atmosphere which was apparent on the Exchange last week, most markets displayed a cheerful tendency. Gilt-edged stocks finished firm, although slight setbacks occurred during the week; the Four-and-a-Half Conversion Loan being most affected. Colonial Government stocks also continued a strong market. Home Rails, however, on account of decreased traffic returns, were dull, and several falls in value were reported; Underground income bonds and shares being a notable exception.

The Industrial Market was well supported, and provided several prominent features; but profit taking in some departments caused a slight reaction in prices. Match shares, headed by Bryant and May's, were again prominent, and Swedish Match and Columbia Graphophone improved on rumours of increased profits. Insurances also continued in demand. Rubber and Tin had a good week, and many of the shares were marked up. As is usual at this time of the year, new capital issues were conspicuous by their absence.

The transactions in the Gas Market were rather less than usual. Eliminating *ex* div. variations, Bristol 5 p.ct. fell ½ to 83½-84½ and Primitiva 3d. to 16s. 9d.-17s. 9d. On the other hand, Gas Light were marked up ½ to 85½-87½ and Newcastle consolidated ½ to 73½-74½. Among the gas dividend announcements the Derby Company are paying 3½ p.ct. for the half-year, against 3 p.ct., and of the unquoted companies Eastbourne 8¼ p.ct. per annum on the "A" stock and 6¾ p.ct. per annum on the "B" stock, and Exeter 10 p.ct. per annum. A correction should be made in regard to the Croydon distribution, which was announced last week as 3½ p.ct. for the half-year; this should have been 3¼ p.ct.

The following transactions were recorded during the week:

On Monday, British 110, Gas Light and Coke 86½, 86⅝, 86¾, 3½ p.ct. 60⅝, 4 p.ct. preference 75¾, 3 p.ct. debenture 58½, 6 p.ct. debenture 102¾, 103½, 5 p.ct. debenture 99, 99⅝, 99¾, Imperial Continental 140, Primitiva 17s., 17s. 4½d., 4 p.ct. consolidated debenture 72, South Metropolitan 102¾, 103$\frac{7}{16}$, 103½, 6 p.ct. preference 109½, South Suburban 5 p.ct. debenture 93¾, Tottenham "B" 91, Tuscan 20s., 20s. 4½d. Supplementary prices, Horley 10 p.ct. "A" 150.

On Tuesday, Bombay 22s., Bournemouth 7 p.ct. 12¾, Continental Union 7 p.ct. preference 86, European 6½, Gas Light and Coke 86½, 86⅝, 86¾, 86⅞, 87, 3½ p.ct. 59⅜, 4 p.ct. preference 75¾, 3 p.ct. debenture 58½, Newcastle-on-Tyne 3½ p.ct. 73, Primitiva 17s., South Metropolitan 103, 103⅜, South Suburban 5 p.ct. 103½, 5 p.ct. debenture 93½, Tottenham "B" 91½. Supplementary prices, Derby 5 p.ct. 105¼, Torquay 5 p.ct. preference 87½.

On Wednesday, Alliance and Dublin 84½, Bournemouth "B" 12¾, 6 p.ct. preference 11⅜, British 109½, 110, Cape Town 8, 8$\frac{3}{16}$, Commercial 87, 87¼, 87⅜, Croydon maximum dividend 79½, 80, Gas Light and Coke 86⅜, 86½, 86⅝, 86¾, 87, 5 p.ct. debenture 99⅝, Montevideo 91½, 92, Primitiva 17s., 17s. 4½d., 4 p.ct. consolidated debenture 72½, South African 92s. 6d., South Metropolitan 6 p.ct. preference 109½, 110½, 6½ p.ct. debenture 103½, Tottenham 4 p.ct. debenture 69½, Wandsworth 5 p.ct. preference 85. Supplementary prices, Liverpool 5 p.ct. 85, 86.

On Thursday, Alliance and Dublin 85, Cape Town 8$\frac{3}{16}$, European 6⅜, Gas Light and Coke 86⅜, 86⅝, 86⅞, 87, 3½ p.ct. maximum 60½, 4 p.ct. preference 75½, 3 p.ct. debenture 58½, 58¾, Imperial Continental 3½ p.ct. debenture 69½, 69½ *ex* debenture, Montevideo 91½, Primitiva 16s. 7½d., 16s. 9d., 16s. 10½d., 17s., South Metropolitan 101 *ex* div., 6 p.ct. preference 109½, Wandsworth, Wimbledon 101½. 102½.

On Friday, Alliance and Dublin 85, British 109¾, Commercial 87½, Gas Light and Coke 86½, 86⅞, 87, Imperial Continental 139, 141, Montevideo 92½, Primitiva 16s. 9d., 17s., 17s. 3d., South Metropolitan 101½, 101¾, South Suburban 5 p.ct. debenture 95. Supplementary prices, Montevideo 6 p.ct. debenture 98½.

Optimism still continues with regard to the future monetary position. While no reduction is expected in the Bank Rate, the easing of the situation in the United States, the firmness of the exchange, and, above all, the improved gold position at home justify the belief that there will be no increase in the rate. Funds were in ample supply in Lombard Street at the end of the week, although money was in small demand. Old day-to-day loans were renewed at 3½ p.ct., while fresh advances were available down to 3 p.ct. Treasury Bills were allotted at the higher average rate of £4 7s. 2.53d. p.ct., against £4 6s. 5d. p.ct. the previous week.

The Foreign Exchange Market was quiet, and no violent changes were recorded. Sterling on New York remained firm at 4.86$\frac{3}{8}$. The Dutch and Belgian rates finished slightly higher at 12.12⅞ and 34.92⅞ respectively. Swiss francs closed at 25.21 and German marks 20.44½.

Silver recovered on Chinese buying at 25$\frac{7}{16}$d. per oz., while Gold remained at the nominal price of 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21. The banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2¾ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Aug. 12.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 10	5	5	Aldershot 5 p.c. max. C.	70—73	..	..
223,992	,,	,,	4	4	Do. 4 p.c. Pref.	63—71	..	..
1,551,868	,,	Apl. 7	6½	7	Alliance & Dublin Ord.	84—87	..	84½—85
274,000	,,	July 14	4	4	Do. 4 p.c. Deb.	64—67	..	..
520,554	,,	—	—	—	Barnet Ord. 7 p.c.	101—104	..	..
800,000	1	Apl. 28	1/7½	1/7½	Bombay, Ltd.	1—1⅛	..	22/-
170,000	10	Mar. 10	8½	8½	Bournemouth 5 p.c.	12⅝—13½	..	..
600,050	10	,,	7	7	Do. B 7 p.c.	12½—12⅝	..	12⅝
375,000	10	,,	6	6	Do. Pref. 6 p.c.	11—11½	..	11½
80,000	Stk.	June 29	3	3	Do. 3 p.c. Deb.	54—57	..	..
168,025	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
367,900	,,	—	—	—	Brighton & Hove 5 p.c. Con.	106—109	..	..
341,800	,,	—	—	—	Do. 5 p.c. Con.	94—97	..	..
1,827,800	,,	July 28	5	5	Bristol 5 p.c. max.	83½—84½a	−½	..
885,000	,,	Mar. 24	6	7	British Ord.	108—111	..	109½—110
180,000	,,	June 29	7	7	Do. 7 p.c. Pref.	112—117	..	..
100,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	78—78	..	..
300,000	,,	,,	—	33/2	Do. 5 p.c. Red. Deb.	94—96	..	..
100,000	10	May 26	6	6	Cape Town, Ltd.	7⅞—8½	..	8—8$\frac{3}{16}$
100,000	10	Apl. 28	4½	4½	Do. 4½ p.c. Pref.	8—7	..	..
180,000	Stk.	June 29	4½	4½	Do. 4½ p.c. Deb.	70—75	..	..
666,860	,,	July 28	6	6	Cardiff Con. Ord.	97—100	..	..
357,560	,,	June 29	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
157,180	,,	Aug. 11	6½	6	Chester 5 p.c. Ord.	84½—89½*	−2	..
79,185	1	Apl. 28	1/2-	1/2-	Colombo Ltd. Ord.	20/—21/-	..	..
34,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	20/—22/-	..	..
331,490	1	Apl. 7	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	24/8—26/6	..	..
173,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,075,320	Stk.	July 14	—	5	Commercial Ord.	86½—88½	..	87—87⅞
475,000	,,	June 16	3	3	Do 3 p.c. Deb.	56—59	..	..
200,000	,,	Sept. 30	12	11	Continental Union, Ltd.	34—37	..	..
200,000	,,	Mar. 10	7	7	Do. 7 p.c. Pref.	84—86	..	86
787,580	,,	Aug. 11	6½	6½	Croydon sliding scale	98—99*	−1	..
408,100	,,	,,	5	5	Do. max. div.	77—80*	−1	79½—80
492,870	,,	Feb. 24	6	9	Derby Con.	104—106a	..	..
53,000	,,	June 29	4	4	Do. Deb.	73—75c	..	..
300,000	,,	Mar. 10	5	5	East Hull Ord. 5 p.c.	76—80	..	..
60,000	,,	June 16	5	5	Eastbourne 5 p.c. Deb.	90—95	..	..
1,009,180	10	Mar. 24	†3	†3	European, Ltd.	6½—6⅝	..	6⅜—6½
19,747,460	Stk.	July 28	5	5	Gas Light & Coke 4 p.c. Ord.	85½—87½	+½	86½—87
1,000,000	,,	,,	3½	3½	Do. 3½ p.c. max.	59—61	..	59⅝—60½
4,187,090	,,	,,	4	4	Do. 4 p.c. Con. Pref.	74¼—76½	..	75½—75⅝
6,008,620	,,	June 16	3	3	Do. 3 p.c. Con. Deb.	58—60	..	58½—59⅜
191,815	,,	,,	6	6	Do. 6 p.c. Br'if'd Rd. Db.	100—103	..	102⅝—103½
1,648,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	98—100	..	99—99⅝
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
83,800	,,	Mar. 10	6½	6½	Hastings & St L. 5 p.c. Conv	90—92	..	..
388,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	67—72	..	..
70,000	10	Apl. 28	†10	†10	Hongkong & China, Ltd.	12—18	..	..
179,300	Stk.	Mar. 10	5	5	Hornsey Con. 5½ p.c.	67—69	..	..
1,976,000	,,	May 19	10	10	Imperial Continental Cap.	139—141	..	139—141
265,130	,,	Aug. 11	3½	3½	Do. 3½ p.c. Red. Deb.	68—70*	−1	69½—69½
285,242	,,	Aug. 11	6½	7	Lea Bridge 5 p.c. Ord.	94—97*	−1	..
3,145,807	,,	Aug. 11	5½	5½	Liverpool 5 p.c. Ord.	82⅞—83½b*	−2½	..
800,000	,,	Sept. 30	7	7	Do. 7 p.c. Red. Pref.	103—105b	..	..
185,786	,,	Feb. 24	9	8	Maidstone 5 p.c. Cap.	110—115	..	..
68,490	,,	June 16	3	3	Do. 3 p.c. Deb.	50—55	..	..
75,000	5	June 16	†7	†8	Malta & Mediterranean	5—5½	..	..
841,920	Stk.	May 26	†5	†7	Montevideo, Ltd.	90—92	..	91½—92½
2,061,815	,,	July 28	5	5	Newcastle & Gateshead Con.	73½—74½d	+½	..
860,929	,,	,,	4	4	Do. 4 p.c. Pref.	66½—67½d	..	..
901,705	,,	June 29	3½	3½	Do. 3½ p.c. Deb.	66½—67½d	..	..
131,786	,,	—	—	—	North Middlesex 5 p.c. Con.	91—93	..	..
300,000	,,	Apl. 28	9	7	Oriental, Ltd.	100—102	..	..
186,130	,,	June 29	7½	7½	Plym'th & Ston'house 5 p.c.	102—107	..	..
414,800	,,	Feb. 24	7½	7½	Portsm'th Con. Stk. 4p.c. Std.	102—105	..	..
486,782	,,	,,	5	5	Do. 5 p.c. max.	76—79	..	..
2,389,909	1	—	—	—	Primitiva Ord.	16/9—17/9	—/3	16/7½—17/4½
369,200	100	June 1	4	4	Do. 4 p.c. Red. Deb.	84—86	..	..
800,000	Stk.	July 28	4	4	Do. 4 p.c. Red. Deb. 1911	71—73	..	..
494,968	,,	June 29	—	4	Do. 4 p.c. Cons. Deb.	71—73	..	72—72½
180,000	10	Mar. 24	6	6	San Paulo 6 p.c. Pref.	7½—72	..	..
135,000	50	June 29	5	5	Do. 5 p.c. Red. Deb.	46—49	..	..
270,000	Stk.	Mar. 24	5½	5½	Sheffield A	99—101e	..	..
419,808	,,	,,	5½	5½	Do. B	99—101e	..	..
1,047,000	,,	,,	5½	5½	Do. C	99—101e	..	..
80,000	10	May 26	4	6	South African	4—6	..	4⅜
6,809,895	Stk.	Aug. 11	7	5	South Met. Ord.	101—103*	−1	101—103⅞
500,000	,,	—	—	—	Do. 6 p.c. Irred. Pf.	109—112	..	109½—110½
1,895,445	,,	July 14	3	3	Do. 3 p.c. Deb.	56—59	..	..
784,000	,,	Mar. 10	6½	6½	Do. 6½ p.c. Red. Db.	103—104	+1	103½
91,800	,,	Aug. 11	8½	8½	South Shields Con.	101—103d*	−3	..
1,945,796	,,	July 28	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	103½
888,887	,,	June 16	5	5	Do. 5 p.c. Deb.	92—95	..	93½—95
647,740	,,	Mar. 24	5	5	South'mpton Ord. 5 p.c. max.	74—77	..	..
191,575	,,	June 29	4	4	Do. 4 p.c. Deb.	71—74	..	..
350,000	,,	Feb. 24	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
300,000	,,	June 16	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
190,000	,,	July 28	7½	7½	Tottenham District A 5 p.c.	105—108	..	..
893,375	,,	,,	6½	6½	Do. B 3½ p.c.	89—92	..	91—91½
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95—98	..	..
181,355	,,	June 16	4	4	Do. 4 p.c. Deb.	70—78	..	69½
356,251	,,	Mar. 10	5	5	Tynemouth Con. and New Urbridge, Maidenhead, &	72½—78½d	..	..
289,094	,,	Mar. 10	6½	6½	Wycombe 5 p.c.	85—90	..	..
58,820	,,	,,	5	5	Do. 5 p.c. pref.	88—88	..	..
30,000	,,	July 14	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	117—122	..	..
385,688	,,	,,	7	7	Do. B 3½ p.c.	100—105	..	..
423,635	,,	,,	5/19/0	5/19/0	Do. C and New	88—93	..	..
350,000	,,	,,	6⅝	6⅝	Do. Wimbledon 5 p.c.	98—103	..	101½—102½
90,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	100—105	..	..
300,000	,,	,,	5	5	Do. 5 p.c. Pref	83—88	..	85
86,416	,,	June 29	8	8	Do. 3 p.c. Deb.	52—55	..	..
384,743	,,	,,	4	4	Do. 4 p.c. Deb.	73—76	..	..

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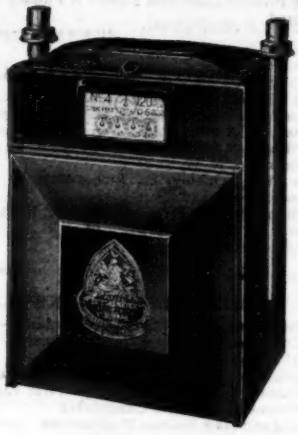

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